# plating

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RESEARCH

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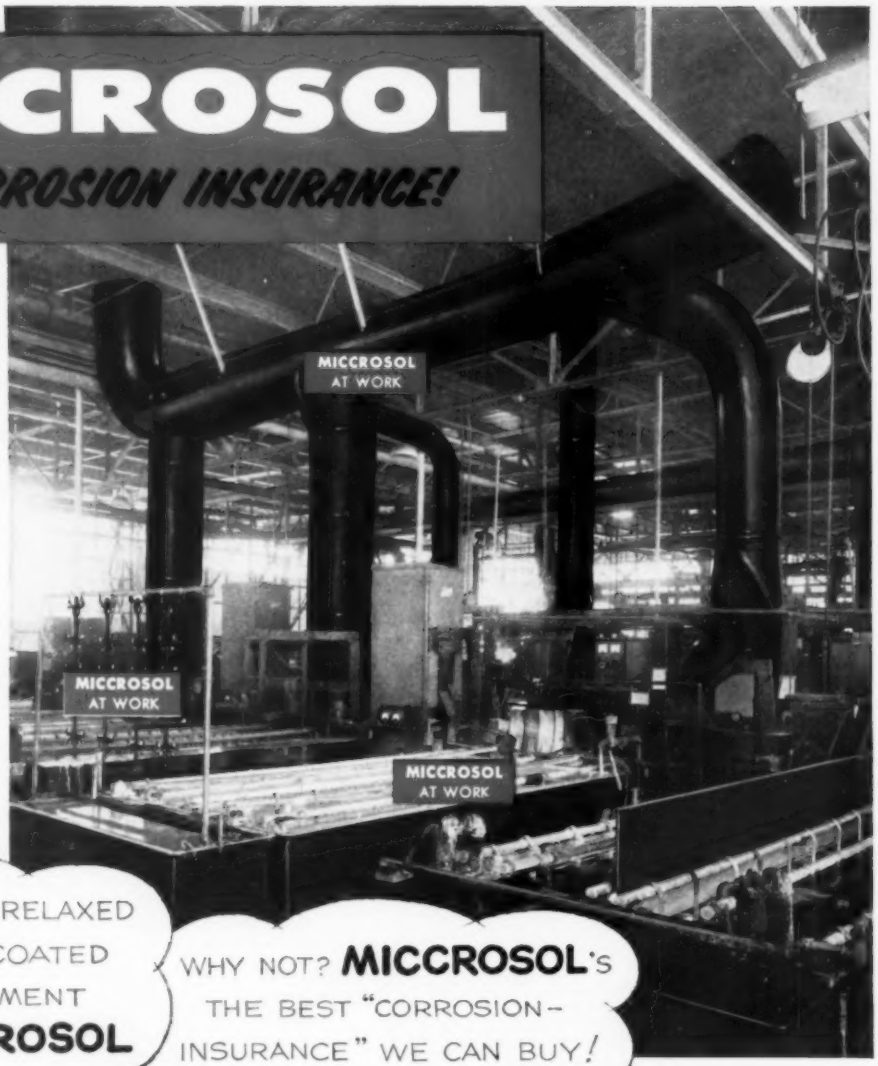

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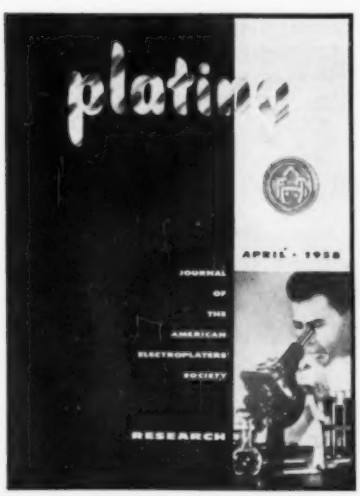


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# plating

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Published by the American Electroplaters' Society, Incorporated, 445 Broad Street, Newark 2, N. J. Phone: HUmboldt 2-3400. Yearly subscription for Members $2.00. Nonmembers U. S. and Canada $5.00, 65c a copy. Foreign, $8.00 a year, $1.00 a copy.

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PLATING is abstracted regularly in Chemical Abstracts, Metals Review, Metallurgical Abstracts, Engineering Index, Technical Data Digest, and Bulletin Analytique.

Statements of fact and of opinion given in articles and papers in PLATING are those of the contributors. The American Electroplaters' Society assumes no responsibility for them.

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Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916.

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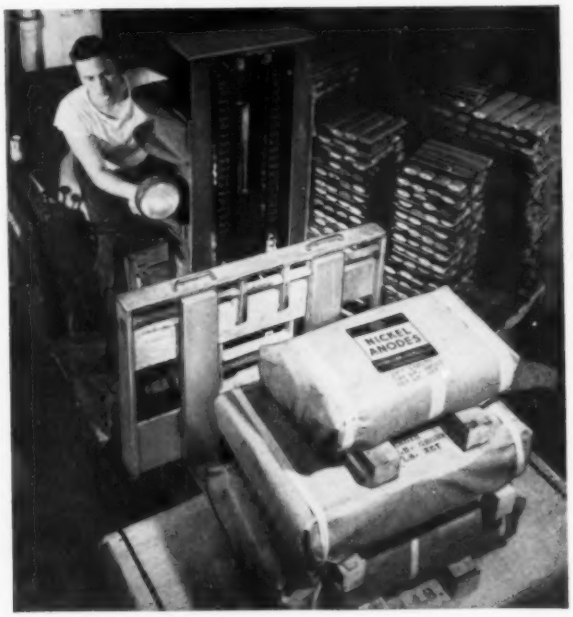


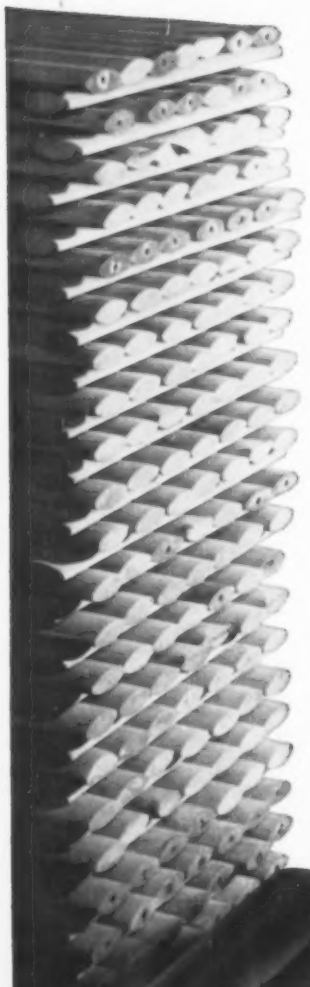

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# EDITORIAL

## RESEARCH AND DEVELOPMENT

THE importance of research cannot be questioned in a country where private industry spends several hundred million dollars yearly for basic research. Since basic research is conducted without consideration for immediate commercial application, this indicates great foresight on the part of American management.

Inasmuch as many new products and processes result from the further development and application of the information gained from basic research, it is not surprising that the field of applied research is even larger because the objectives are more definite and the returns more immediate.

Neither field of research is independent of the other and the lines of demarcation between the two areas are not very distinct. It is difficult for the "basic" research worker to be entirely unaware of the practical significance of some of his results and the "applied" research worker frequently discovers something other than that which was intended.

Successful laboratory research results in the discovery of potentially useful products or processes, but this is only the beginning. Much more development work must ensue if the public is to benefit.

Organized research being dependent on communication between workers for rapid exchange of ideas is essentially a development of the twentieth century.

It is the aim of the AES Research Program to conduct both basic and applied research—and to publish the results. By this means each member of the Society will be supplied with material that he can individually develop to suit his particular needs.

The section of this issue highlighting developments of the AES Research Program in progress in American and Canadian universities and foundations demonstrates the application of the foregoing research distinctions.

*Robert A. Ehrhardt*

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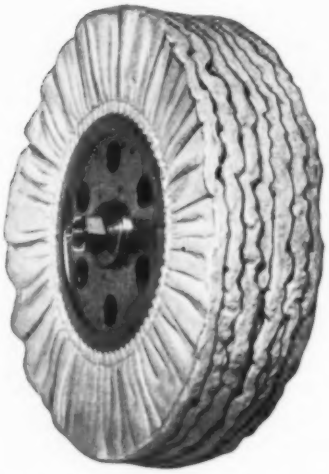

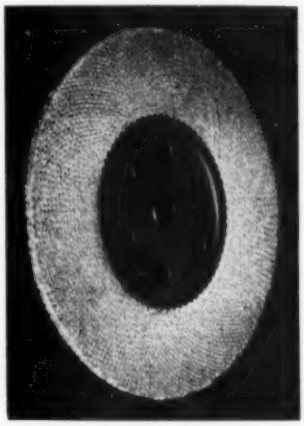

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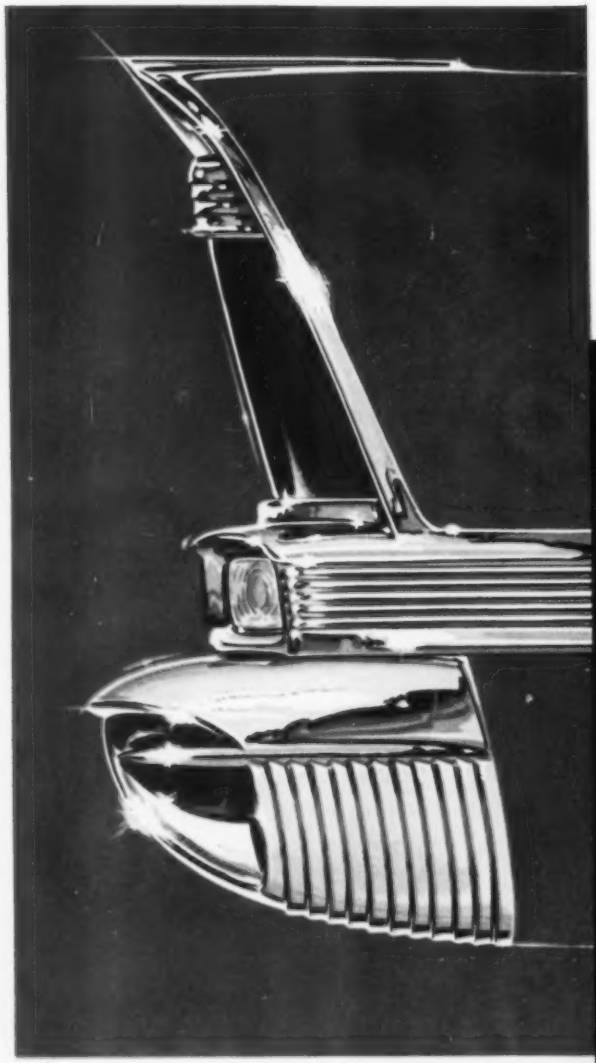

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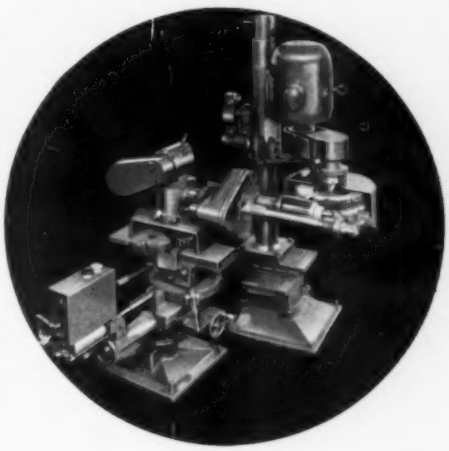

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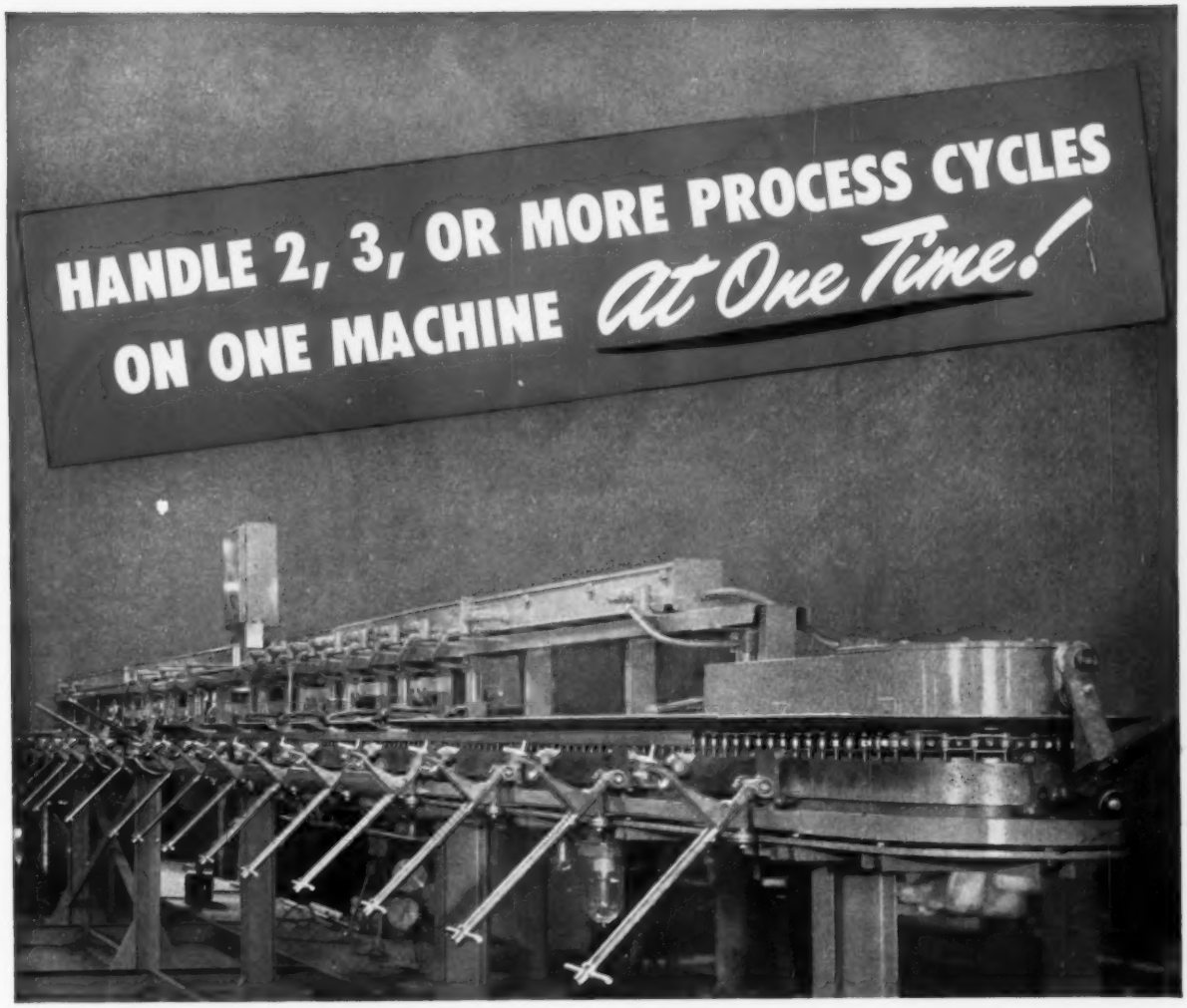


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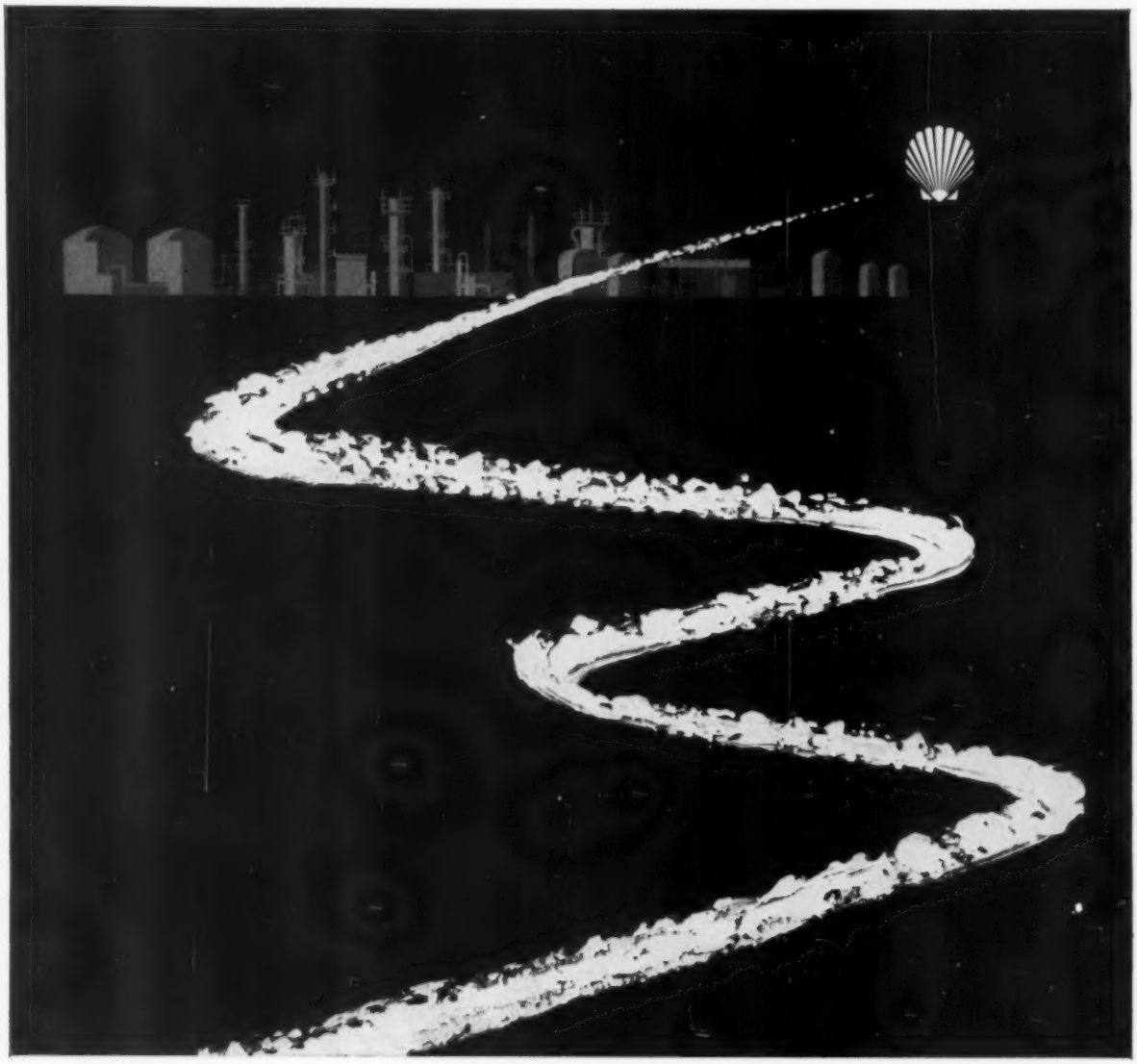

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| | Olive drab finish, maximum corrosion protection. | 1071 (liquid) & 1071A (liquid) | Manual or automatic; no leach | More than 100 hours | USA 57-0-2C Type I QQZ-325 Type II QQP-416 Type II | Hardware, ordnance & communication items. |
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You get all these advantages, and more, with a UDYSIL Rectifier! Silicon, the amazing long life element, combined with a new, revolutionary BALANCED circuit, makes the Udysil line the most advanced series of plating rectifiers ever developed! Only UDYSIL gives you . . .

★ **UNLIMITED CELL LIFE** — The amazing element Silicon assures you the longest life ever for a plating rectifier. Hermetically sealed, the cells won't "age" . . . can't ever wear out!

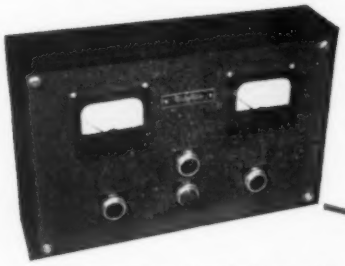
★ **UNEQUALED DEPENDABILITY** — The new BALANCED circuit power means no more "blowing" of stacks through uneven cell loading — no more complex individual cell protection devices — no more ruined parts and loss of production from a shut down rectifier.

★ **UNAFFECTED BY HIGH TEMPERATURES** Inducted cooling is employed to obtain 1000 to 1200 feet of ventilation through the stacks—allows high temperature operation. UDYSIL rectifiers can now operate at full work load even in room temperatures up to 120° F. with no reduction in efficiency, voltage or cell life!

★ **UNIMPEDED APPLICATION** — UDYSIL can be used in any plating bath, it has a 4.2 ripple factor over the entire voltage range. Complete variety of voltage and ampere capacities available (see specifications).

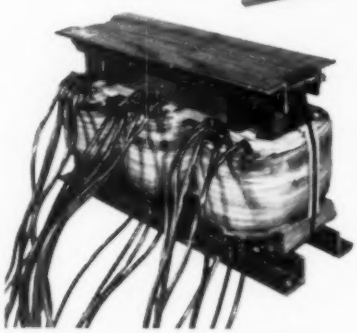
★ **UNSURPASSED ECONOMY** — UDYSIL offers you economy *two* ways. With a power factor of 92%, your installation costs are low, no more paying for wiring that you don't need. And, with UDYSIL's exceptionally high efficiency you save on operating expenses!

All these *exclusive* advantages are yours when you select UDYSIL. In addition, all transformers contain high quality, glass-wound insulation for maximum protection against moisture and chemical attack. Now, here's the inside story on UDYSIL!



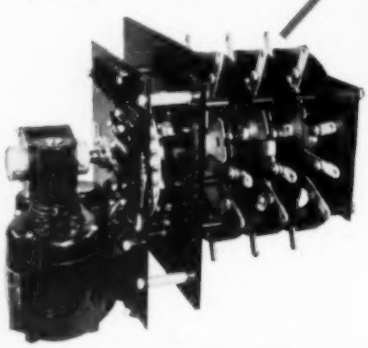
**Removable Control Panel**

Here's the removable control panel that can be retained on the front of the rectifier or mounted remotely anywhere in your shop. Big, easy-to-read dials give you a quick visual check on performance.



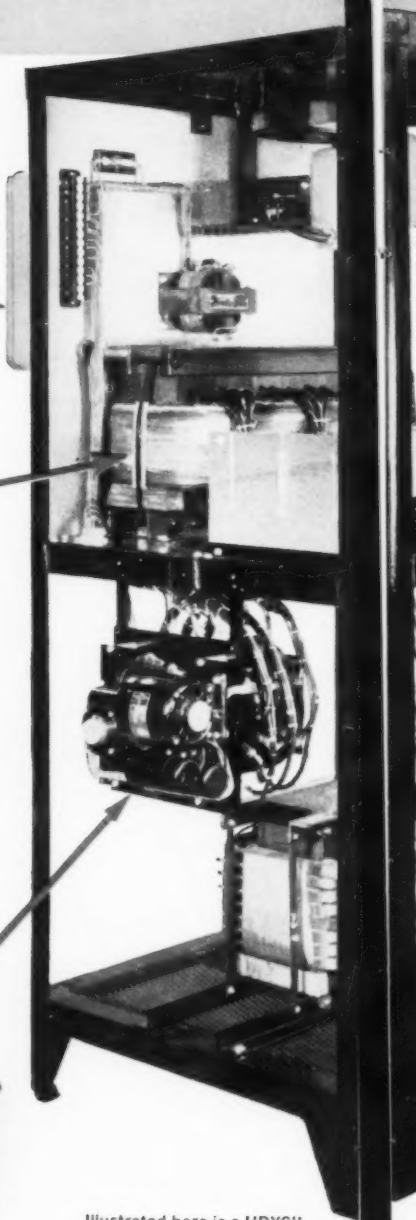
**Regulator Transformer**

A familiar item on all Udylite rectifiers, this transformer assures you proper voltage and current regulation when you need it. UDYSIL is also available without regulation, if preferred.



**Motor Driven Tap Switch**

UDYSIL rectifiers are available either with this motor driven tap switch or a manual integral unit. Eight taps per phase allow 22 steps of regulation over the D.C. voltage range.

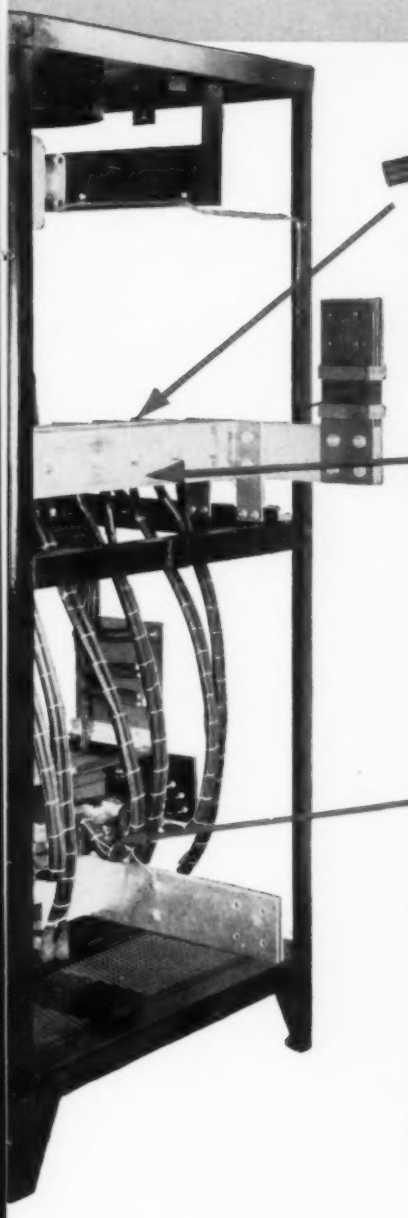


Illustrated here is a UDYSIL 2000 Ampere Rectifier.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 410.

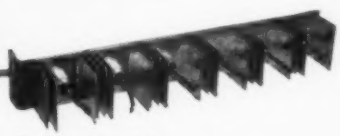
# UDYSIL

## WITH BALANCED POWER



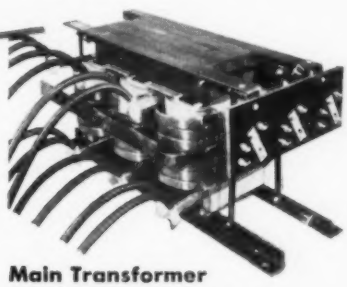
### Silicon Cell

Here is the Silicon Cell, the non-aging, unlimited life "heart" of the new UDYSIL rectifier. Hermetically sealed, this cell allows a lifetime of service. No loss of efficiency occurs with Silicon no matter how much . . . or how little the rectifier is in use.



### Cell Assembly

This cell assembly is designed to allow the utmost in cooling and ventilation. The cells are hooked up in three independent single phase tap circuits. Six cells comprise a rating of 1000 amps. Multiples of six cells are used as ampere ratings increase. (Example) In the rectifier illustrated here, the UDYSIL 2000, two such assemblies are included for a total of 12 individual Silicon cells.



### Main Transformer

This *BALANCED* Main Transformer was designed to give each cell of Silicon a uniform output. By balancing the amount of current that each cell is required to carry, UDYSIL can now develop uniform efficiency without overstressing the load on any one cell. This *BALANCED* Transformer and the new Silicon cell make a combination that is unbeatable for long life and high efficiency.

**Udysil is available with optional features**
**. . . to meet your every operating need exactly!**

- ★ Equipment can be supplied for any degree of voltage control. A vernier can be added to provide control steps intermediate to those of the tap switch.
- ★ Induction regulator for high current requirements.
- ★ Constant voltage control
- ★ Constant current control
- ★ Constant average current density control
- ★ Automatic programming

### SPECIFICATIONS

| AMPERE CAPACITY | VOLTAGE CAPACITY | KVA CAPACITY |
|---|---|---|
| 1000 | 6 | 8.6 |
| 1000 | 9 | 13.0 |
| 1000 | 12 | 16.0 |
| 1000 | 18 | 24.0 |
| 1000 | 24 | 30.0 |
| 1500 | 6 | 13.0 |
| 1500 | 9 | 19.0 |
| 1500 | 12 | 24.0 |
| 1500 | 18 | 36.0 |
| 1500 | 24 | 45.0 |
| 2000 | 6 | 17.0 |
| 2000 | 9 | 26.0 |
| 2000 | 12 | 32.0 |
| 2000 | 18 | 48.0 |
| 2000 | 24 | 60.0 |
| 3000 | 6 | 26.0 |
| 3000 | 9 | 39.0 |
| 3000 | 12 | 48.0 |
| 3000 | 18 | 72.0 |
| 4000 | 6 | 34.0 |
| 4000 | 9 | 52.0 |
| 4000 | 12 | 64.0 |
| 5000 | 6 | 43.0 |
| 5000 | 9 | 65.0 |
| 6000 | 6 | 52.0 |
| 6000 | 9 | 78.0 |

**Additional capacities are available on request.**

the udylite corporation

*detroit 11, michigan • world's largest plating supplier*

# Daily savings with Wagner Rectifiers...

## plus less upkeep and downtime

Part of a shipment of 38 Wagner Germanium Rectifiers, 13 regulators and three automatic plating machines for a leading business machine manufacturer.

Just what does the higher efficiency of Wagner Selenium Electroplating Rectifiers mean to *you?* Of interest to management-minded men is the day to day *decrease* in the use of AC current—and in most plating shops that is a big item. *Why* less current? Because the comparatively greater stack area for a similar *rating* (up to 40% more rectification area) results in lower temperature rise, hence more DC power delivered to your tank for the AC input.

Then there are even greater but less predictable savings. The conservative ratings of Wagner Rectifiers due to the ample stack areas mean longer stack life (less chance of burn-outs) and ample capacity for overloads. You virtually eliminate interruptions for maintenance with the resultant idle labor and loss of production, not to mention the cost of replacing stacks. Wagner transformers, too, are specially designed for electroplating applications; they are provided with Class B non-flammable insulation (glass, mica, asbestos, etc.) for safety and extra long service life. Cooling fans are standard, easily replaced in minutes, and in the event of a ventilating failure, the rectifier may be operated without exceeding the maximum safe operating temperature; Wagner Rectifiers do not reach this point until subjected to an overload of 500% of normal rating.

Cost-minded? Weigh these day by day savings, plus the greatly reduced maintenance costs of Wagner Rectifiers—*plus* the *safety* features which extend the life of this valuable equipment—and call the Wagner man in your area. If you have an electroplating problem—or a parts handling problem before or after plating—lay it in his lap and we'll pitch in to work out a solution. Remember, Wagner Brothers is your *one* source for anodes, chemicals, rectifiers, automatic and semi-automatic equipment, all manufactured by one company.

MANUFACTURERS AND PROCESSORS OF ALL METAL-FINISHING CHEMICALS, ANODES, AND EQUIPMENT

**425 MIDLAND AVE., DETROIT 3, MICHIGAN**

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Wagner BROTHERS INC.

# HOW WAGNER SERVICE CUT PLATING COSTS 20%

Fred Janke (right), Works Manager, to Angelo Comito, Superintendent of Hancock Mfg. Co., Jackson, Michigan: "A major saving in our plating department is the elimination of maintenance of rectifiers. Wagner's suggestion has stopped corrosion and stack replacements."

You've heard manufacturers of industrial equipment talk of their "service"—but all too often service is indefinite, and as time proves, of little real benefit to you. But *some* service is effective and Wagner Brothers' service comprises a good part of the commodity you buy.

For example, when Hancock Manufacturing Company asked several plating equipment manufacturers to submit suggestions for improving the efficiency of their zinc plating department, Wagner Brothers jumped at the chance to demonstrate the real meaning of "service". No other vendor saw room for improvement—but Wagner Brothers' representatives analyzed Hancock's problems and came up with answers which have paid off in the most tangible ways—in better plating, reduced maintenance, more production from the existing automatics and competitive pricing. Here's how:

- Rectifiers were changed from individual 1500 amp. units to 5000 and 6000 amp. Wagner selenium cubicles installed in an adjacent room with control panels in the plating room.
- Solutions were replaced with Wagner proprietaries.
- All buss bars were replaced with buss of greater capacity to increase the productivity of the automatics.
- Racks were redesigned, principally with larger hooks for better handling of internal auto hardware—locks, hinges, window regulators, etc.
- New grease traps were installed to reduce contamination of solutions.
- Checks are made frequently and regularly by Wagner technical men and sales representatives to insure proper balance of solutions.

The changes described above have resulted in improved quality and a complete elimination of Hancock's great problem, the continuous replacement of rectifier stacks. As other problems arise, they are immediately tackled by the Wagner men who check the operation on an average of once a month to cut losses at the source.

So there's the Wagner meaning of "service". Why not call our representative in your area so that you, too, may see Service in Action.

MANUFACTURERS AND PROCESSORS OF ALL METAL-FINISHING CHEMICALS, ANODES, AND EQUIPMENT

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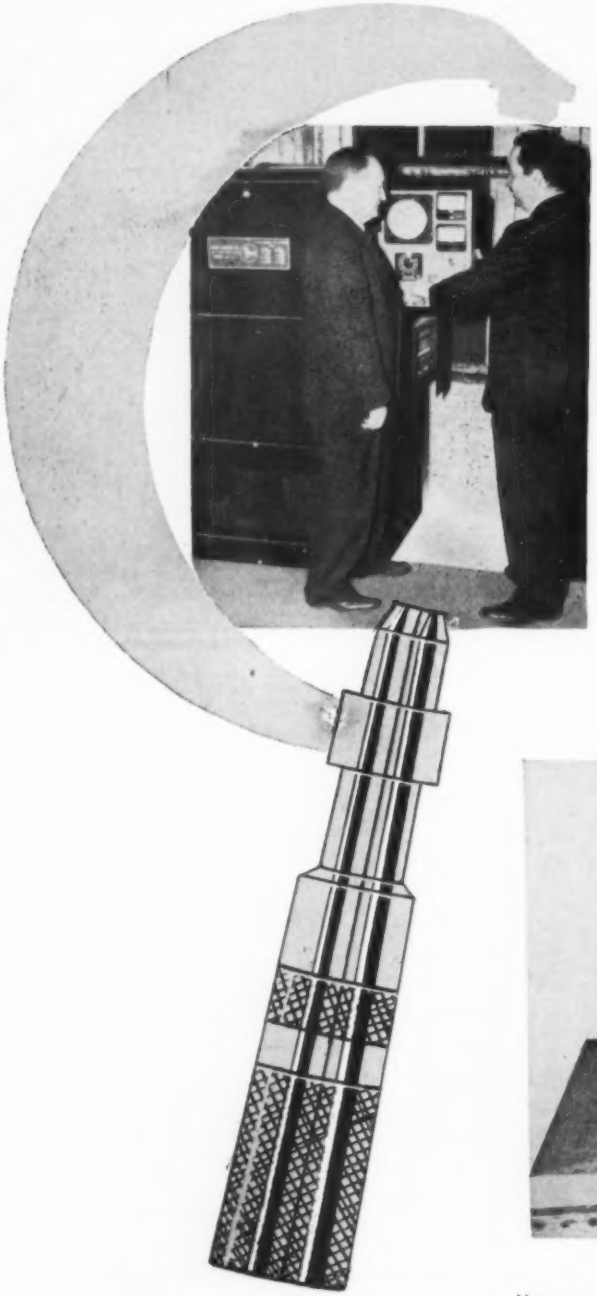
Wagner BROTHERS INC.

# *Accurate Anodizing Company* relies on RAPID

## automatic rectifier control for precision anodizing . . .



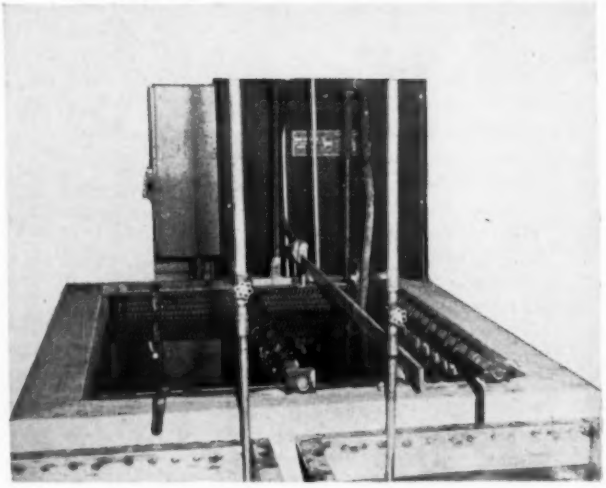
ACCURATE ANODIZING COMPANY of Chicago, Illinois, is a specialist in *Hard Coat Anodizing.

Maintaining a standard of quality indicative of its name is a constant challenge.

When special rectifying equipment was required to meet extremely critical specifications and close tolerances, A. A.'s staff consulted RAPID engineering specialists.

Recommendations of automatic voltage stabilization and step programming were acted upon. Result: Accurate thicknesses – held to close tolerances – accomplished automatically.

* Patented Process



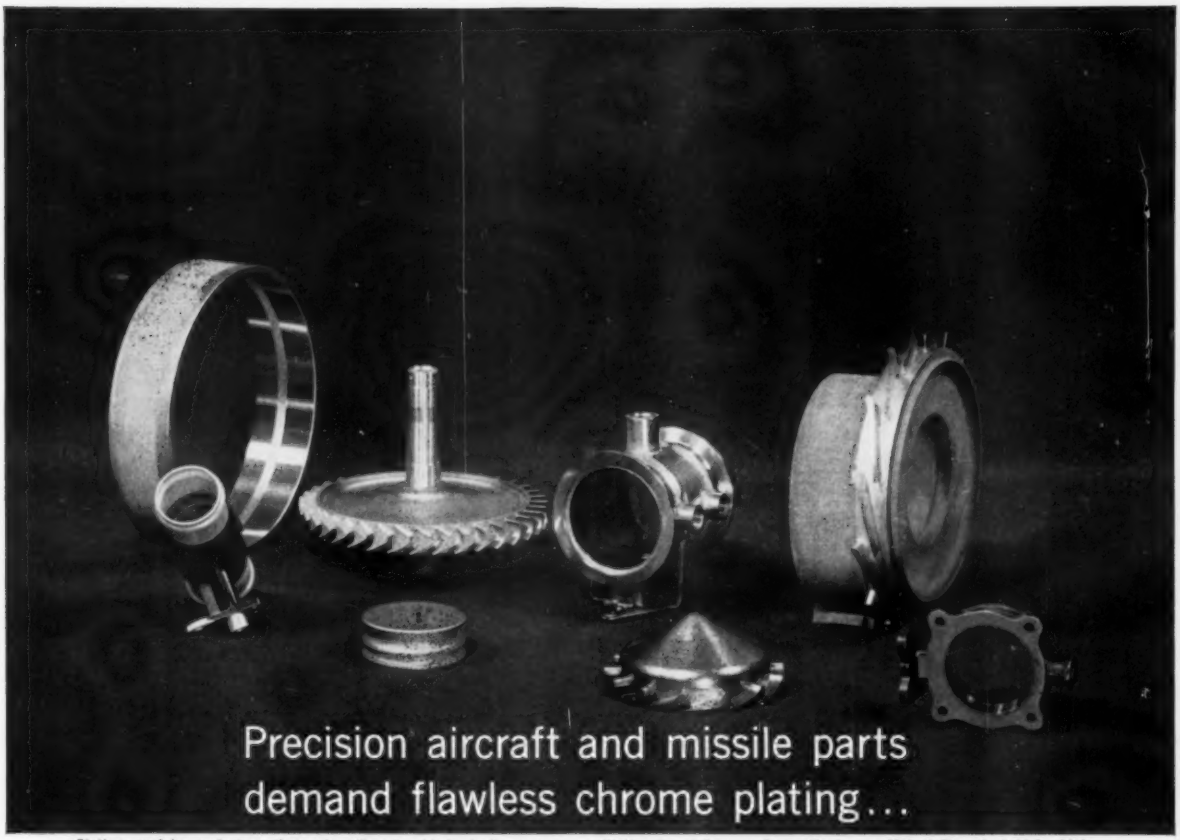
INDICATE A 413.

*Have you a special power requirement?*
*Professional consultation service available without obligation.*
*Why not call us to-day?*

THE NAMEPLATE THAT MEANS *"More Power to You!"*

**RAPID ELECTRIC COMPANY**

12838 Fenkell Avenue • Detroit 27, Mich. • Diamond 1-8537
2881 Middletown Road • New York 61, N. Y. • TAlmadge 8-2200




Plating must be perfect on these aircraft and guided missile components, made according to rigid government specifications. Precision Plating Co. of Somers, Connecticut, uses Mutual Chromic Acid for high plating accuracy—and dependable product performance.

## For the best chrome plating use

# MUTUAL low-sulfate CHROMIC ACID

Experienced platers working with close tolerance specifications have found the best way to maintain accurate control of the acid-sulfate ratio in the plating bath is to use Mutual low-sulfate Chromic Acid.

Mutual Chromic Acid is always 99.75% pure—or better. Sulfate content never exceeds 0.1%. Rigid Mutual quality control guarantees uniformity of the product—a safeguard against plating difficulties and expensive rejects!

For further information about Mutual Chromic Acid, send today for "Chromium Chemicals." This booklet contains useful technical information about the entire line of Mutual Chromium Chemicals. The Mutual Technical Service Staff will also be pleased to offer expert help.

## Mutual Chromium Chemicals

MUTUAL

**Sodium Bichromate**
**Sodium Chromate**
**Chromic Acid**

**Potassium Bichromate**
**Potassium Chromate**
**Ammonium Bichromate**

Mutual Chromium Chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast.

**MUTUAL CHROMIUM CHEMICALS**
**SOLVAY PROCESS DIVISION**
**Allied Chemical & Dye Corporation**
**Dept. 8, 61 Broadway, New York 6, N. Y.**

Allied Chemical

Please send me Bulletin #52—Chromium Chemicals—Their History, Properties and Uses.

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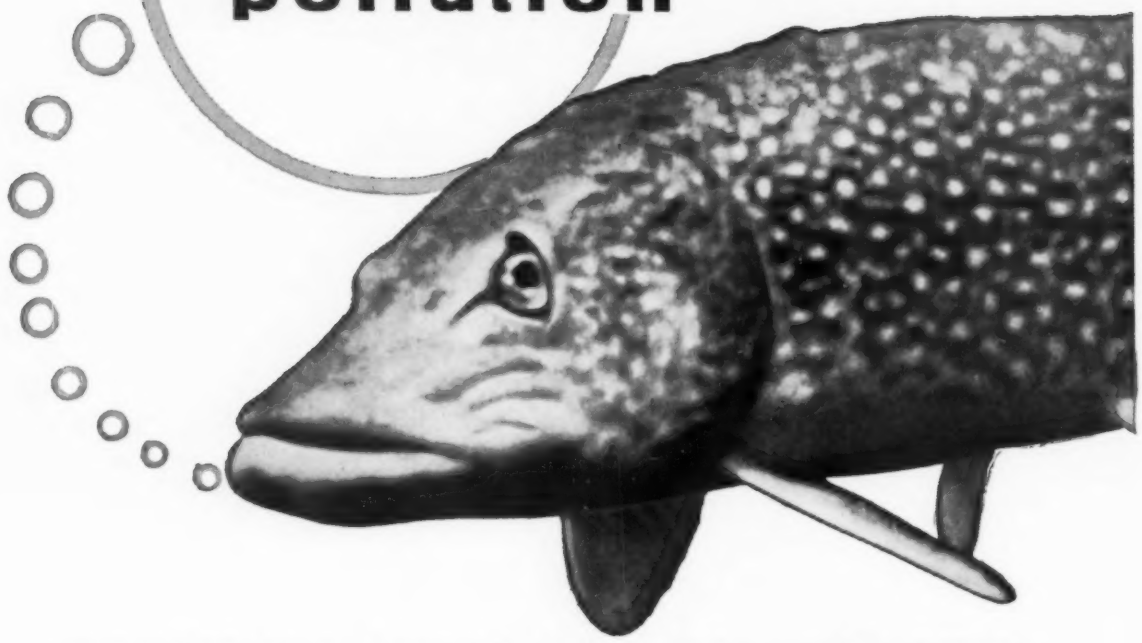
COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____

# stop stream pollution



## neutralize cyanide waste with HTH

Chlorine's ability to convert poisonous cyanide to relatively harmless cyanate . . . plus the convenience of a *dry*, 70% available chlorine product . . . explains the ever-widening use of HTH to treat cyanide waste in the metal processing industry.

With HTH, in either granular or tablet form, you enjoy all the advantages only a dry chlorine product can give. There's no mixing or messing with solutions . . . no handling or storing of carboys . . . no need for trained operators or expensive equipment.

HTH arrives *ready for use*. It's chlorine in *dry* form that can be added directly to waste solutions. It's perfectly safe and simple to store, use, and handle at all times.

**Free-flowing, fast-dissolving HTH Granular.** Packed in 100-lb. drums and in cases of nine 5-lb. cans.

**Slow-dissolving HTH Tablets.** For your protection, every genuine HTH Tablet is stamped H T H. Packed in 100-lb. drums and in cases of twelve 3¼-lb. cans.

If you would like more information on the use of HTH for effective, economical treatment of cyanide waste, write today.

OLIN MATHIESON CHEMICAL CORPORATION
INDUSTRIAL CHEMICALS DIVISION • BALTIMORE 3, MD.

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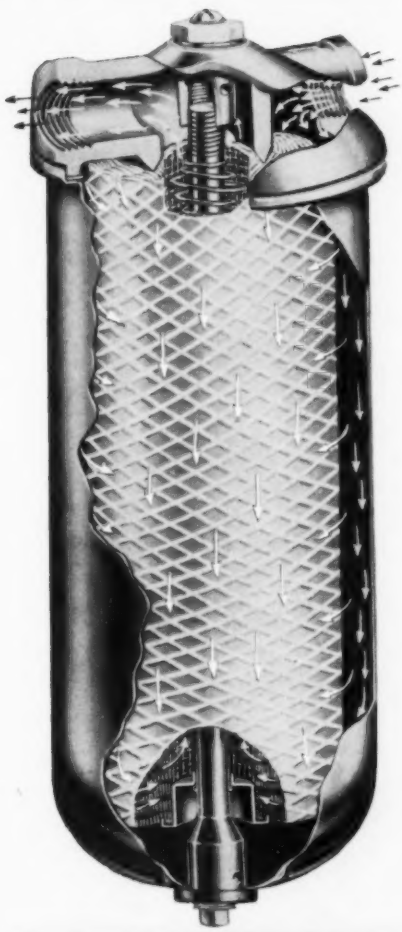
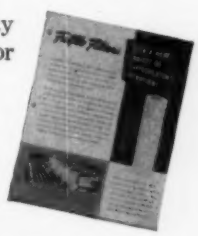


Strong, compact, economical — this new SSB10 Fulflo Filter is made with a rugged one-piece drawn shell of #316 stainless steel. Simplified construction is reflected in exceptionally low cost.

The new Fulflo Filter is especially recommended for small plating tanks, with one to one-hundred gallon capacity, for precious solutions of gold, silver, platinum, etc., as well as cyanide. You can achieve turnover of one or more times per hour. Filter is available in two pipe sizes — ⅜ or ¾ inch. Standard model is for operating pressures up to 150 psi.

To resist solutions chemically hostile to cotton, 10-inch Honeycomb Filter Tubes are available in a variety of synthetic fibres: nylon; orlon; dacron; dynel; acetate; or glass fibres. Wide range of densities enables you to get the exact degree of micro-clarity you need. Honeycomb Filter Tubes have hundreds of precision controlled filtering tunnels to provide true *depth* (not just surface) filtration. These diamond-shaped tunnels are engineered for absolute uniformity in size, shape, depth and density.

Other Fulflo Filters include high capacity models to provide complete tank turnover for large tanks up to three times per hour.



*Write for new catalog to Department PL.*

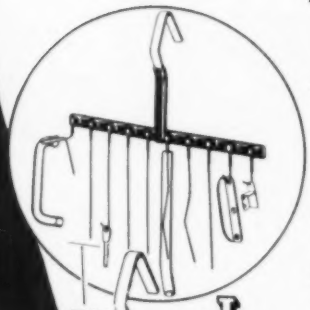
**COMMERCIAL FILTERS CORPORATION**
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

**MICRO-CLARITY AT MINIMUM COST**

Fulflo FILTERS
*with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.*

CFC FILTERS
*Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.*

# *New,* Ready Made Mass-produced *Economy* Plating Racks



STYLE **L**

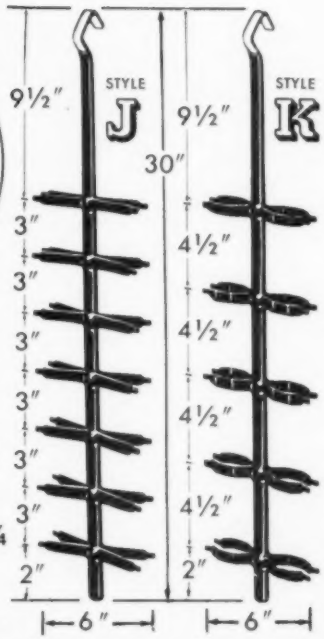
7⅜"

8¼"

14½"

**$4.50**

Straight .093 dia. phosphor bronze wires; 8" long, 1½" centers. Wires easily shaped or shortened.

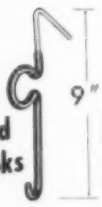



Tips 1/16x1/2" **$6.50**

Tips 1/16x1/2" **$5.75**

***36" lengths available***

STYLE **M**



9"

**Insulated "S" Hooks**

¼" copper rod heavy plastisol coat

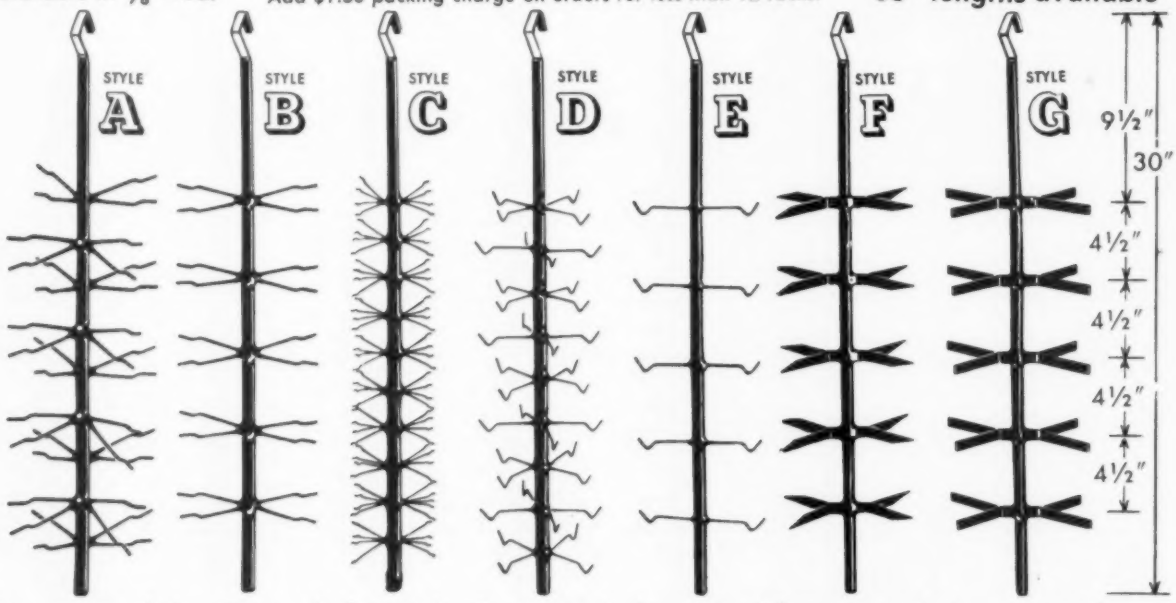
**Less than 100, $.45**

**100 or more, .40**

available in ⅛" rod.

**$2.45**

*Add $1.50 packing charge on orders for less than 12 racks.*




Tips .114" dia. **$5.78**

Tips .114" dia. **$4.77**

Tips 1/16" dia. **$6.00**

Tips 3/32" dia. **$5.83**

Tips 3/32" dia. **$4.42**

Tips 1/16x1/2" **$5.84**

Tips 1/16x1/2" **$5.69**

Spines one-piece solid copper round cornered and sand blasted. Tips phosphor bronze, riveted to spine and soldered when necessary for complete rigidity. Coated after assembly with BELKE Universal Plastic.

**Belke MANUFACTURING COMPANY**

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***Unique new brightener for zinc and cadmium plated parts*** has been developed by Federated: CONMAX, a conversion coating for plated finishes from brilliant to iridescent, provides corrosion resistant film to zinc and cadmium plate. Other high quality, low-cost brighteners from Federated: ZIMAX for all types of zinc plating, still, automatic, and barrel; CADMAX for cadmium plating; NIMAX, highly concentrated brightener for nickel barrel plating. These brighteners undergo rigid competitive tests before approval for sale. This also applies to Federated's complete line of plating anodes and nickel salts. It's safest when you specify plating supplies from Federated Metals Division of American Smelting and Refining Company, 120 Broadway, New York 5, N. Y. In Canada, Federated Metals Canada, Ltd., Toronto and Montreal.

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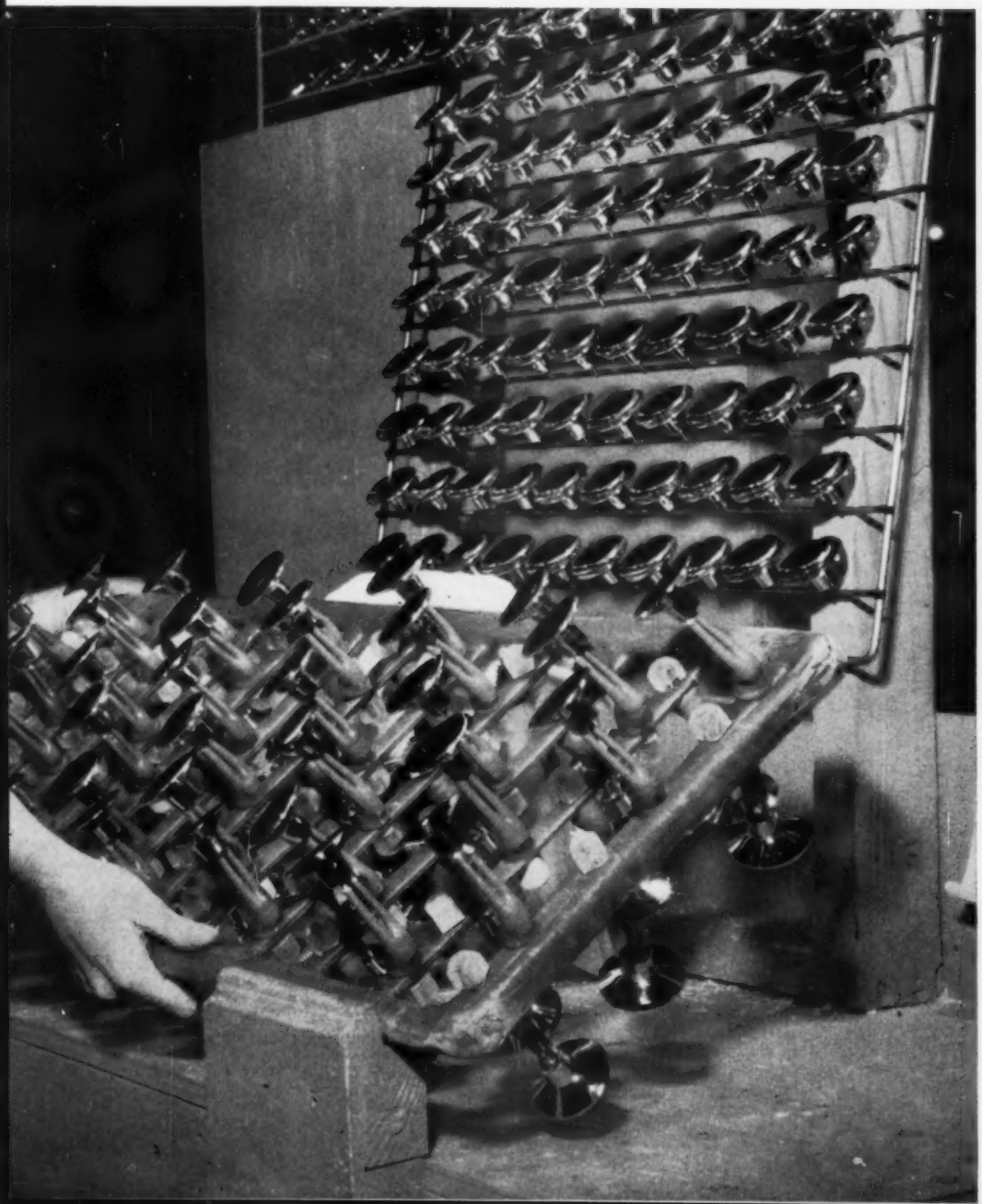

**ASARCO**

AMERICAN SMELTING AND REFINING COMPANY

# "THIS STEVENS BARREL PLATING MACHINE IS SAVING EATON THOUSANDS OF DOLLARS...

## ...and it's completely automatic!" says R. J. Munsey

R. J. Munsey
Division Industrial Engineer
Reliance Division
Eaton Mfg. Co.
Massillon, Ohio

A Stevens Automatic Barrel Plating Machine, with *one* operator is cadmium plating 1,750 pounds of lockwashers, Springtites, and Keps an hour for Eaton. It has also . . .

- INCREASED PRODUCTION 270%
- REDUCED REJECTS TO LESS THAN 1%
- REDUCED REQUIRED FLOOR SPACE BY 400 SQ. FT.

These savings, both in supplies and labor, mean volume production for Eaton Manufacturing Co. They've discovered, as have an increasing number of progressive companies, that Stevens equipment assures maximum production and superior quality.

Lower costs, consistent quality and assured production are only a *few* of the reasons why Stevens Automatic Barrel Plating Machines are the leaders in their field. For more details, contact your local Stevens Sales Representative today! Find out why more and more metal finishers are looking to Stevens for production savings.

**Remember—When you go Automatic...go Stevens!**

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DAYTON NEW HAVEN SPRINGFIELD (OHIO)

# Ideal Tack Rags

## FOR A PERFECT FINISH ON

**AUTOMOBILES, REFRIGERATORS, METAL PRODUCTS, RADIO CABINET, AEROPLANES, FURNITURE, PLASTICS, etc. where Synthetic Enamel, Lacquer or Thinners are used.**

## IDEAL TACK RAGS

Are made of a special cloth soft, smooth and flexible, saturated with a solution specially prepared to produce the "tack" that lasts indefinitely and will not ignite by spontaneous combustion.

YOUR PAINT MANUFACTURER WILL RECOMMEND IDEAL TACK RAGS HIGHLY.

**IDEAL TACK RAGS** are a superior product to use for the practical finishing job, either high class or medium price work.

**IDEAL TACK RAGS** are an improvement over the old type tack rags or old fashioned home-made kind that are expensive, impractical and obsolete.

**IDEAL TACK RAGS** are chemically treated to remain tacky indefinitely to produce the tack for the secret of the perfect finish.

Packed in glassine bags, flatly folded to be used as a pad or may be opened up and used.

---

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**February 12-13, 1958**
**Hotel Statler, St. Louis**


Summary by
Dr. Edward B. Saubestre

Chemistry Laboratory
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Member ASTM Committee
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*Sub-I (Specifications):*

Chairman—FIELDING OGBURN

R. B. Saltonstall reported on a new footnote proposed for A-166-55T, B-141-55 and B-142-55 which will point out that for a given corrosion performance, the thickness of nickel deposits required will depend on the type of nickel plating solution used, and on use of subsequent buffing. This will be submitted for balloting in B-8. Standards A-166, B-142, B-200 and B-201 had a footnote added dealing with revised salt spray requirements. Specification A-219 was submitted for action by Sub-III. The problem concerns use of a spot test for determining thickness of chromium deposits. Modifications of the Specification will mention possible use of other tests, and point out that the spot test for chromium is unreliable over copper deposits. Also, to measure chromium thickness over stainless steel, a different test solution must be used. Any spot test solution must be re-standardized when using proprietary chromium plating solutions. These proposals will be submitted to letter ballot in B-8.

*Section A (Specifications):*

Chairman—H. KAFARSKI

A footnote has been added to A-165-55, dealing with toxicity of cadmium, especially when heated, as in soldering or welding. This will be balloted in B-8. A-166 was re-confirmed as a tentative specification, in the light of the work in AES Project 15 on corrosion. B-200 was also re-confirmed as a tentative specification, since questions have arisen concerning the corrosion resistance of Ni-Cr coatings over a copper flash. B-201 was re-confirmed as a tentative specification, in light of work in Sub-V on chromating of cadmium coatings.

*Section B (Definitions):*

Chairman—W. H. SAFRANEK

A listing of about 200 definitions will be circulated to the members prior to the Fall meeting.

*Section C (Electroless Nickel):*

Chairman—W. MOLINE

A monograph of eight chapters, dealing with all aspects of electroless nickel plating, has been nearly completed and is almost ready for submission to the editorial section.

*Section E (Editorial):*

Chairman—F. A. LOWENHEIM

This section has begun to function, and is now receiving all specifications under the jurisdiction of Sub-I.

*Section F (Labelling):*

Chairman—E. B. SAUBESTRE

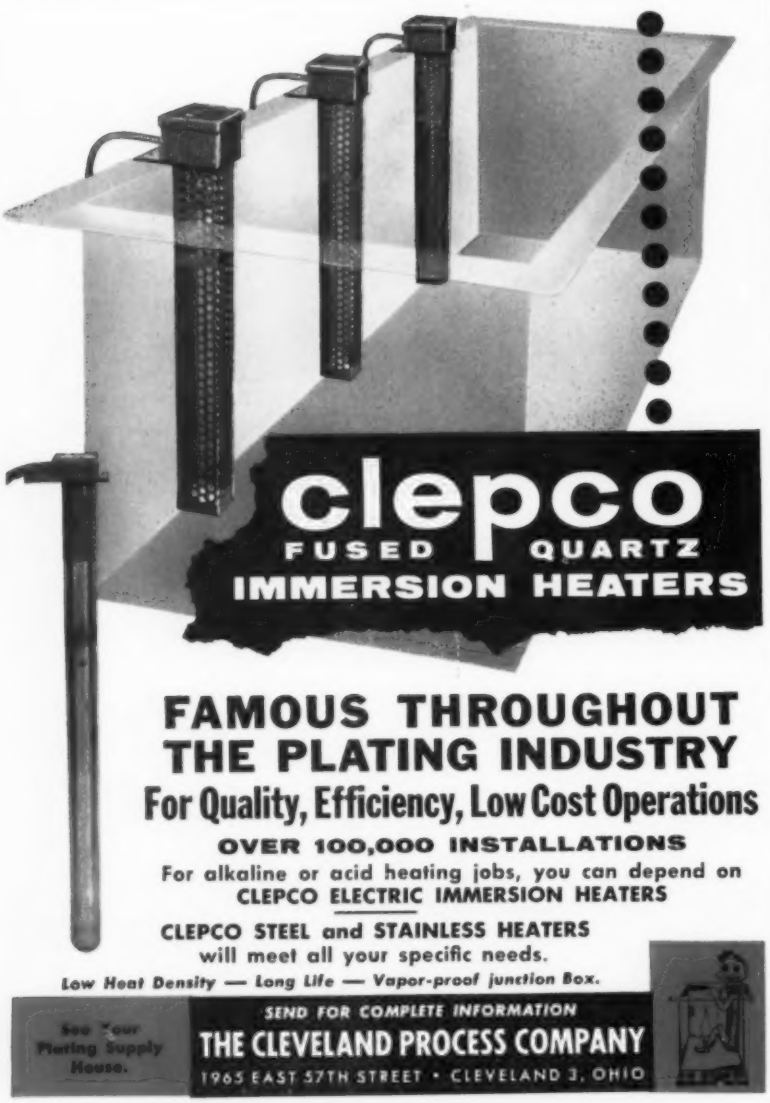
Since the last meeting, the members have found considerable interest in, and support for, the idea of labelling plated coatings. Some objections have been brought up, such as the fear that labelling will be ineffective since the quality of many plated articles, from the consumers' viewpoint, depends on many factors other than the quality of the plating. In fact, even where corrosion resistance is involved, the quality of the article may depend more on the final organic coating than on the plated coating. In view of the interest expressed, the section members will shortly contact various professional, trade, wholesaling, and retailing organizations to plan future activities of this group.

*Sub-II (Performance):*

Chairman—W. L. PINNER

*Section A (Corrosion):*

Chairman—D. M. BIGGE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There is insufficient data at present to draw conclusions concerning corrosion of the Cu-Ni-Cr panels. It is hoped that a report will be ready in October.

*Section C (Zn, Cd):*
Chairman—R. E. Harr
Samples are now on test and are being inspected. No results as yet.

*Section E (Tin):*
Chairman—F. A. Lowenheim
Solderability testing of tin coatings on steel is under way, time and temperature conditions on the tester having been agreed upon. Wettability of the coating will be determined by measuring height of a blob of solder after a flow treatment. Coatings will be 0.5, 2, 5 mils thick, and will be tested under controlled storage conditions, and under uncontrolled storage, such as in a commercial warehouse. Publication of a review is under consideration, dealing with methods of testing for solderability.

*Section F (Aluminum):*
Chairman—J. W. Kerstetter
The section has prepared standard photos for evaluating degree of corrosion of nickel on aluminum. Plating of the test specimens will begin this Summer.

*Sub-III (Conformance):*
Chairman—R. F. Ledford

*Section A (Thickness):*
Chairman—A. H. DuRose
Round-robin tests have been completed in which thickness of coatings was determined by microscopic cross-sectioning, chemical dropping tests, and by various commercial methods involving use of anodic stripping, magnetic properties, and RF currents. Magnetic methods showed least variation between laboratories, but led to high readings on rough surfaces. Conventional chemical dropping tests showed the poorest precision and the poorest accuracy. Lab-to-lab variations on the latter ran as high as 43 per cent. Most commercial instruments tested were quite satisfactory, but some gave inaccuracies which were traced to calibrating errors. It is felt that better calibrating techniques might be desired for many of these instruments. All the work done to date has been on flat surfaces.

*Section B (Porosity):*
Chairman—A. Mendizza
Work will be done comparing the results obtained with the old salt spray test and the new one recommended by AES Project 15.

*Section E (Adhesion):*
Chairman—R. Shaw
A list of adhesion tests and specifications is being compiled.

*Section F (Stress):*
Chairman—L. Morse
An industry round-robin covering use of flat strip, spiral contactometers, and Stresometer methods is nearly complete.

*Section G (Ductility):*
Chairman—P. Croly
This new section will consider various tests, such as the micrometer test for foils, per cent elongation as measured on a tensile tester, and the bulge test.

*Sub-IV (Plating Practice):*
Chairman—M. Frager

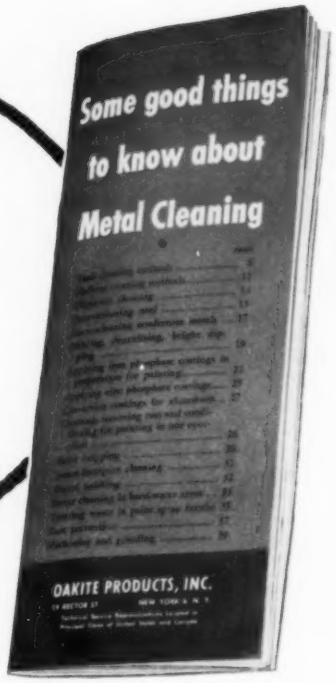
*Section K (Cleaning):*
Chairman—S. Spring
A letter ballot on a monograph on preparing metals for electroplating drew several negatives notes, which were reconciled at the meeting. Most comments were of an editorial nature. Among the technical points raised were comments on improvements in solvent-emulsion cleaners, such that they may now be used effectively in immersion applications; recommendations on ultrasonic cleaning; clarification of the very limited role of saponification in cleaning, and a distinction between fatty acids and fatty oils in this regard; limitations on the use of cathodic-anodic cleaning cycles for most metals, and preference for straight anodic cleaning.

*Section N (Double Nickel Coatings):*
Chairman—B. Knapp
A draft of a recommended practice for plating nickel on nickel is being prepared. Among the cycles being included are:
1. Ni-buff-active-Ni
2. Ni-polish-activate-Ni

*(Continued on page 394)*

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 423.

# WHICH METAL-CLEANING JOBS WOULD YOU LIKE TO IMPROVE?




¶ Are you cleaning metal in the most economical way? *See page 9 of Oakite's FREE booklet on Metal Cleaning.*

¶ Are you cleaning metal the fastest way? *See page 12.*

¶ Do you need room-temperature cleaning combined in one operation with temporary rustproofing? *See pages 12 and 14.*

¶ Do you know the advantages of *alkaline* pickling? *See page 21.*

¶ Have you compared the values of iron phosphate coating and zinc phosphate coating in preparation for painting? *See pages 22 and 25.*

¶ Can you use a cleaner that removes rust and oil at the same time; often eliminating all need for pickling? *See page 30.*

¶ Do you have trouble stripping epoxy resins, pigment residues, phosphate coatings and under-paint rust? *See page 31.*

¶ How do you clean parts that are too large to be soaked in tanks or sprayed in machines? *See page 31.*

¶ Are you getting full profit out of your finishing barrels? *See page 32.*

¶ What do you do when oversprayed paint neither floats nor sinks in your paint spray booth wash water? *See page 35.*

¶ Do you need better protection against rusting in process or in storage? *See page 37.*

Here is the full table of contents of Oakite's 44-page illustrated booklet called "*Some good things to know about Metal Cleaning*".

Tank cleaning methods
Machine cleaning methods
Ultrasonic cleaning
Electrocleaning steel
Electrocleaning nonferrous metals
Pickling, deoxidizing, bright dipping
Applying iron phosphate coatings in preparation for painting
Applying zinc phosphate coatings
Conversion coatings for aluminum and zinc
Cleaning, removing rust and conditioning for painting in one operation
Paint stripping
Steam-detergent cleaning
Barrel finishing
Better cleaning in hard-water areas
Treating water in paint spray booths
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# AES RESEARCH IN 1957-1958

OUR NATION'S industrial economy stands as a testimonial to the power of research, and as a tribute to the business leaders who regard research as an investment rather than an expense. No greater catastrophe can befall a business than newer and more effective methods or materials in the hands of a progressive competitor.

Many aspects of plating and metal finishing are too complex to permit any company to bear the expense of full research alone. The cooperative research program of the American Electroplaters' Society, Inc. is tailored, therefore, to benefit individual companies by enriching technical and scientific knowledge in electroplating, metal finishing and allied arts through broad and directly useful fact-finding on a shoulder-to-shoulder basis.

This program, developed over a long span of years, embodies research projects sponsored by the AES at a number of American and Canadian universities and foundations pinpointed to specific improvements sought in electroplating, metal finishing and allied arts.

The program is financed by the AES not only by allocation thereto of a share of the annual membership fees of its Active Members and Members-at-Large but also by the Sustaining Memberships financed by a substantial number of American and Canadian industrial companies.

Concerted action now in progress through AES Research is providing the industry with more technical muscle NOW. Effectiveness of the program is derived from wide participation. Though program direction resides in the Society's Research Committee, each project comes under the jurisdiction of a District Supervisor who, in turn, works with individual groups of experts termed Project Directing Subcommittees.

These positions are appointive thus harnessing specialized backgrounds to technical subjects under investigation. Accordingly, many qualified people from industry, government and technical agencies are contributing talents, without remuneration, so that the results of AES Research will be of maximum industry wide utility.

Each project is established with a Director who is on the scene in immediate charge of the work at a university or foundation on a day-to-day basis, the research itself normally being carried out by one or more Research Fellows. Only these Directors and Fellows are compensated for their services.

The results of AES Research over a span of some two decades were summarized in PLATING's May 1957 issue. The following highlights subsequent developments.

**Glade B. Bowman**
Member

**James D. Thomas**
Member

**Kergan Wells**
Member

**Leland M. Morse**
Member

**Leslie L. Diveley**
Member

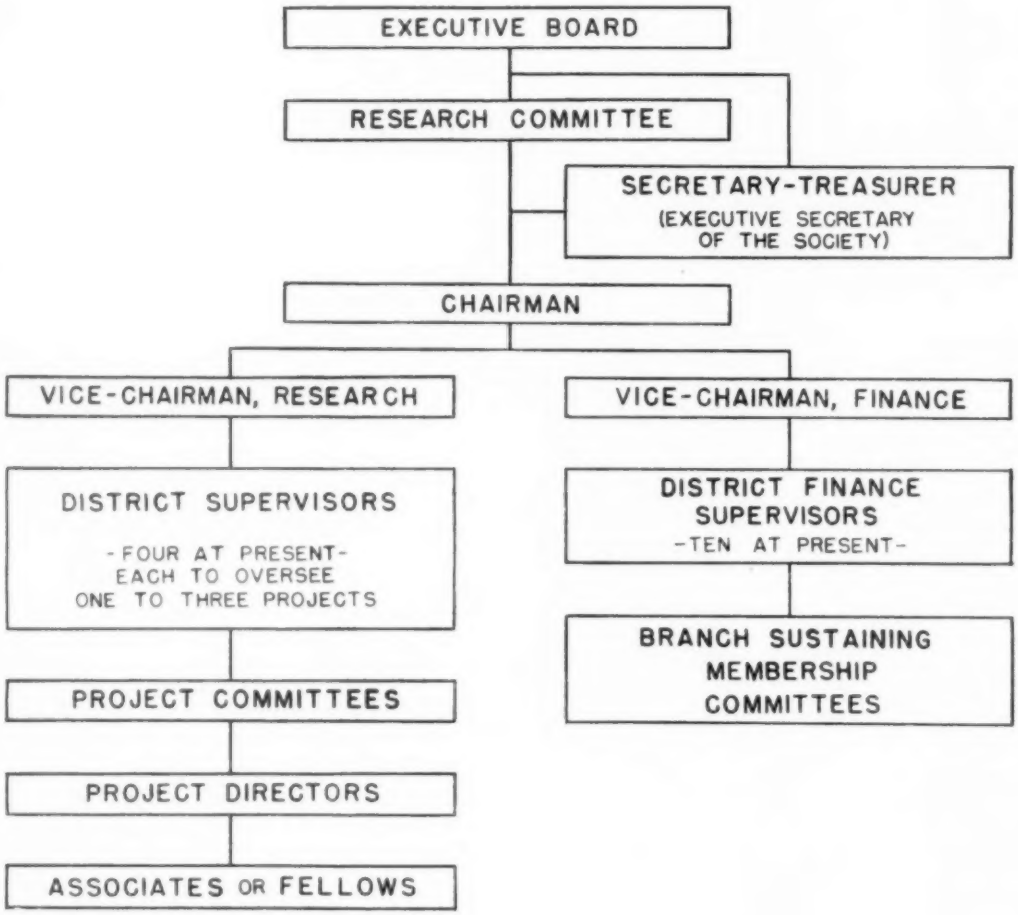
**Clyde Kelly**
District Supervisor

**F. A. Lowenheim**
District Supervisor

**Cleveland F. Nixon**
District Supervisor

**Clarence H. Sample**
District Supervisor

# ORGANIZATIONAL CHART OF THE AES RESEARCH COMMITTEE




NOTICE

Throughout the following summaries of Research Reports and the Bibliography for Research Project No. 18 reference is made to literature published over the years in Monthly Review, Plating, Technical Proceedings and Serial Reports. Much, because of substantial past demand, is now out of print. The Serial Reports still available are listed at the conclusion of this Research Feature Section.

James D. Thomas

# THE AES RESEARCH PROGRAM

## *A PROGRESS REPORT*

by JAMES D. THOMAS
Research Committee

### Forward

Each year it is customary to highlight in one issue of PLATING the activities of the AES Research Program. This is one of the means by which the knowledge gained from the various AES-sponsored Research Projects is disseminated throughout the industry in accordance with the aims of the Society.

The last report in PLATING, May 1957, was extensive in that summaries were presented covering all completed projects and those that are presently active. This article is a report of the activities of the Research Committee and of the progress made by the various projects during the past year.

### The Research Committee

The Research Committee is responsible for the administration of the research program. Although the Research Committee is composed of nine appointed members and one honorary member, the success of the over-all program is made possible by the valuable assistance of about 100 other AES members who serve in various capacities, as shown on the organizational chart.

A part of the duties of the Research Committee is the publication of reports submitted by the various projects. Many of these reports are presented in PLATING. In addition, "Serial Reports" are issued as certain phases of work are completed. Since 1946, there have been 38 of these Serial Reports issued, six (Nos. 33 through 38) of which have been printed this past year. A list of those presently available, and the price per copy, may be found in each issue of PLATING.

At present, seven projects are active at various localities. The Committee feels that a good balance between applied and fundamental studies is being maintained. Although there are obvious relationships between many projects, it is not usually feasible for those associated with a given project to become familiar with, or to discuss, the activities of the other projects. Therefore, a two-day Research Conference was held at the National Bureau of Standards in Washington, D. C., to which all persons actively associated with the Research Program were invited. Informal discussions of each project resulted in a valuable exchange of information and suggestions; the enthusiasm shown by the Project Directors and Research Associates was very noteworthy.

### Project Summaries

The following summaries of the various projects are to afford wider acquaintanceship with the results reported during this past year. Details can be found in the references listed.

---

# SUMMARIES OF AES RESEARCH PROJECTS

**AES Project No. 12**

## CLEANING AND PREPARATION OF METALS FOR ELECTROPLATING

Projector Director—
H. B. LINFORD
Columbia University

Project No. 12, "Cleaning and Preparation of Metals for Electroplating," at Columbia University, has Dr. H. B. Linford as Project Director and J. Desmond and Dr. Venkateswarlu as the Research Fellows.

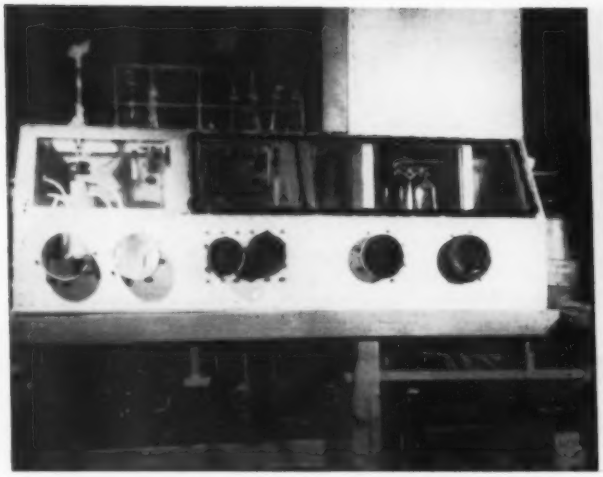
The "Atomizer Test"[1] has been used successfully in correlating the spreading rates and cleanability of oils that are liquid at room temperature.[2] This work was carried further to develop a correlation between the spreading rates of various oils, fats, and greases (which are solid at room temperature) on a particular metal with the cleanability of that soil from another metal.[3] In this manner, the spreading rates of corrosive soils on corrosion resistant metals could be studied. It was shown that for those soils which are solid at room temperature the spreading rates could be studied at elevated temperatures without upsetting the correlation.

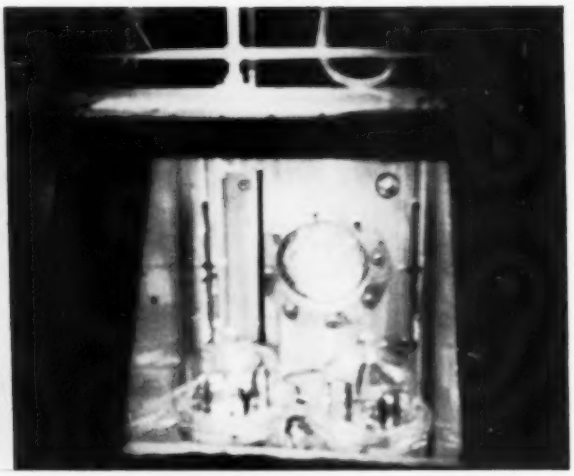
At present, studies of mixed soils are being conducted; to date, the main correlation[4] has not been violated.

In addition to the studies of oil spreading rates, Project 12 is conducting investigations of the effect of copper oxide films on the subsequent deposition of nickel. The studies on the effects of the oxide film thickness on the "apparent current efficiency" of the nickel deposition has been completed, and a report is published in this issue. Based on this study, it was decided to investigate the relationship between the amount of oxide present on the copper and the adhesion of the nickel layer. A quantitative method of measuring the adhesion has been developed and data are being accumulated.

### REFERENCES

[1]Plating, **44**, n. 5, pp. 507–508 (1957).
[2]A. L. Bisio, Master of Science Thesis, Columbia University, New York (1954).
[3]AES Research Report, Serial No. 35.
[4]Linford, H. B., and P. Grubb, Plating, **42**, 895 (1955).





**HELIUM FILLED DRY-BOX USED FOR PROJECT 12 EXPERIMENTAL WORK**

Front of the dry-box. At the left is the vacuum furnace section, plating compartment is in the center, microbalance area at the right.

Close-up of the plating compartment. The glass plating tanks are in the foreground. Not clearly seen at the rear is part of the glove port.

**AES Project No. 13**

## THE NATURE, CAUSE AND EFFECT OF THE POROSITY IN ELECTRODEPOSITS

Project Director—
**FIELDING OGBURN**
National Bureau of Standards

Project No. 13, "The Nature, Cause and Effect of Porosity in Electrodeposits," work is being done at the National Bureau of Standards with Fielding Ogburn as Project Director and Dr. D. W. Ernst as Research Associate.

The gas permeability, photographic and X-ray methods for detecting porosity of electrodeposits were summarized last year. A formal report has since been completed and published.[1]

Further work included the determination of shape and size of several pores by successive polishings parallel to the base. The data can then be used to sketch a cross section of the pore studied. Continuous, dead-end and bridged-over pores were found by this method.

A special plating cell with a transparent bottom was constructed to observe the growth of pores during the plating process. The effect of gas bubbles on pore growth could be seen and indicated possible growth mechanisms.

**REFERENCE**

[1]AES Research Report, Serial No. 36.

**AES Project No. 14**

## THE INFLUENCE OF PHYSICAL METALLURGY AND MECHANICAL PROCESSING OF THE BASIS METAL ON ELECTROPLATING

Project Director—
**M. H. JONES**
Ontario Research Foundation

Project 14, "The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating," is being conducted at the Ontario Research Foundation with Dr. M. H. Jones as Project Director and J. Zajdowski as the Research Fellow.

A paper[1] pertaining to the work of this project was presented at the 44th Annual Convention in Montreal in June, 1957. Factors other than the different ferrous metals discussed in the paper have been investigated. Disturbances and irregularities at the interface between the basis metal surface and the deposit were thought to be sources of corrosion failure. A simplified taper sectioning technique was developed to study this region in greater detail. Highly disturbed zones containing occluded abrasive were observed when steel was grit-blasted.

Inclusion, type as well as size, was found to be important in its effect on durability. Semi-conducting types, such as sulfides, were not as harmful as the non-conducting types, such as silica and alumina.

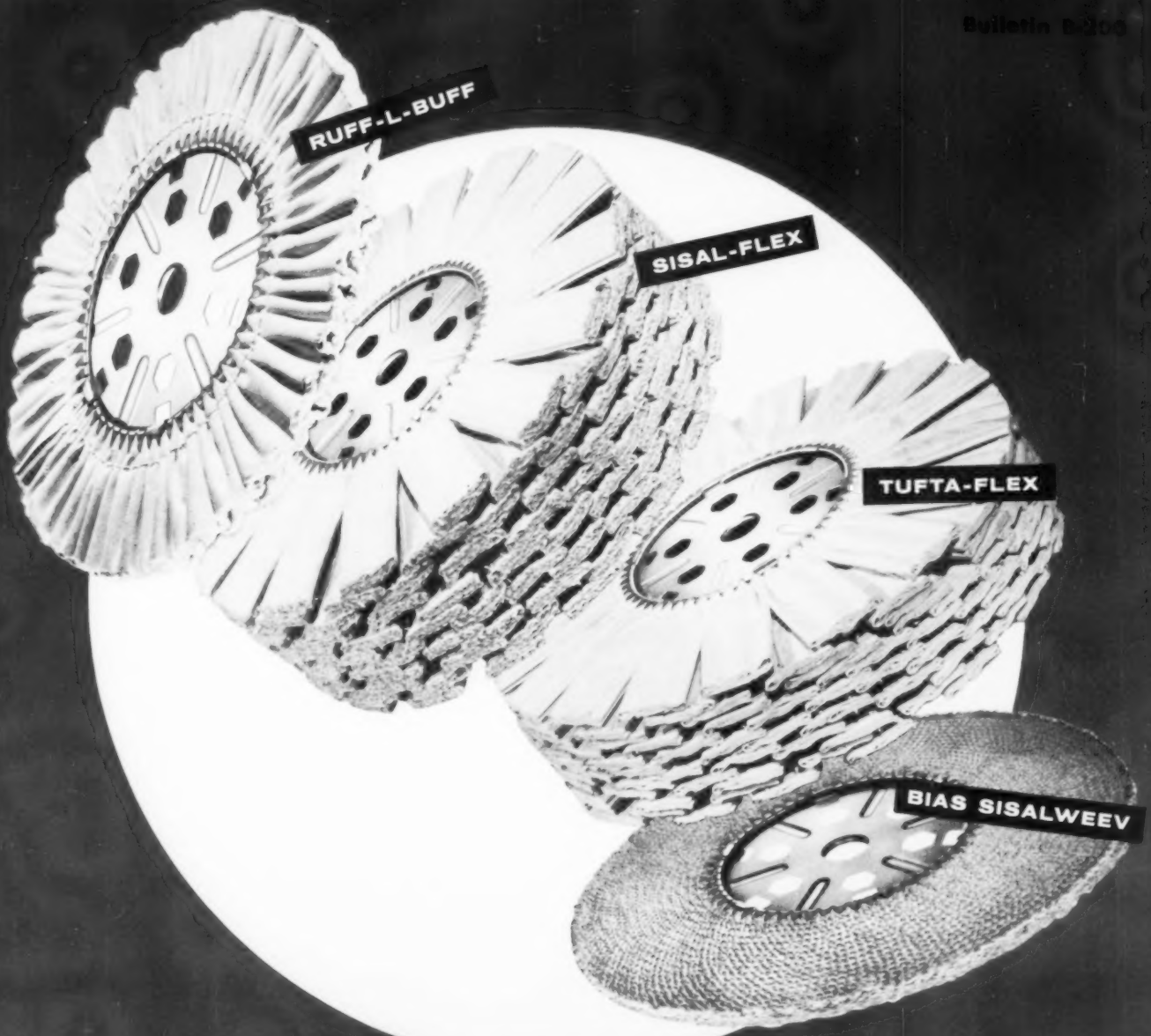
Future work will put more emphasis on study of the deposit. Changes in crystal structure and growth and reasons for these changes will be investigated.

A report of the results of the studies on the effects of different ferrous metals on the performance of a Watts nickel deposit have just been published as AES Research Report, Serial No. 38.

**REFERENCE**

[1]44th Annual Technical Proceedings, AES, pp. 53–69, 1957.

Bulletin B-200

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Tests proved they *cut faster, last 30% longer — in heaviest service.* They're impregnated with buffing compound binder that protects and lubricates every fibre.

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*patent pending

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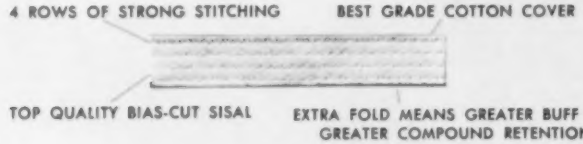
- **Ventilated steel centers**
- **Frayproof, scratchproof construction,** using best grade bias-cut sisal and cotton cloth
- **Four rows of stitching** for extra strength, longer wear

Sisal-Flex buffs are also available with triple-sewn buffing pads. Both types come in standard sizes from 12" to 18" in diameter.


4 ROWS OF STRONG STITCHING
BEST GRADE COTTON COVER
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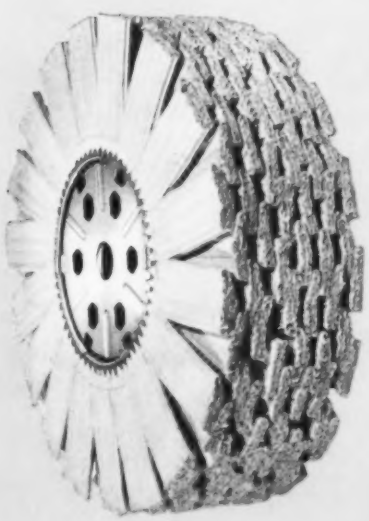
EXTRA FOLD MEANS GREATER BUFF FACE, GREATER COMPOUND RETENTION



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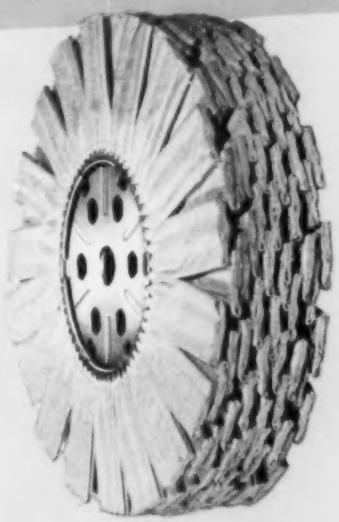

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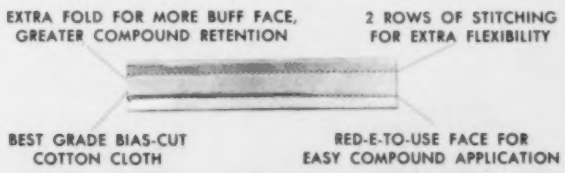
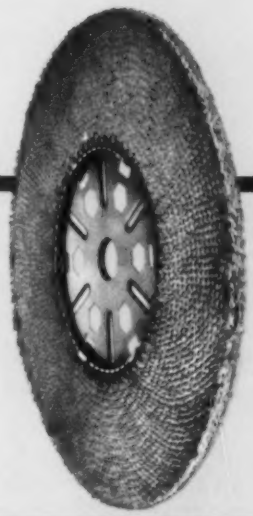

EXTRA FOLD FOR MORE BUFF FACE, GREATER COMPOUND RETENTION
2 ROWS OF STITCHING FOR EXTRA FLEXIBILITY
BEST GRADE BIAS-CUT COTTON CLOTH
RED-E-TO-USE FACE FOR EASY COMPOUND APPLICATION



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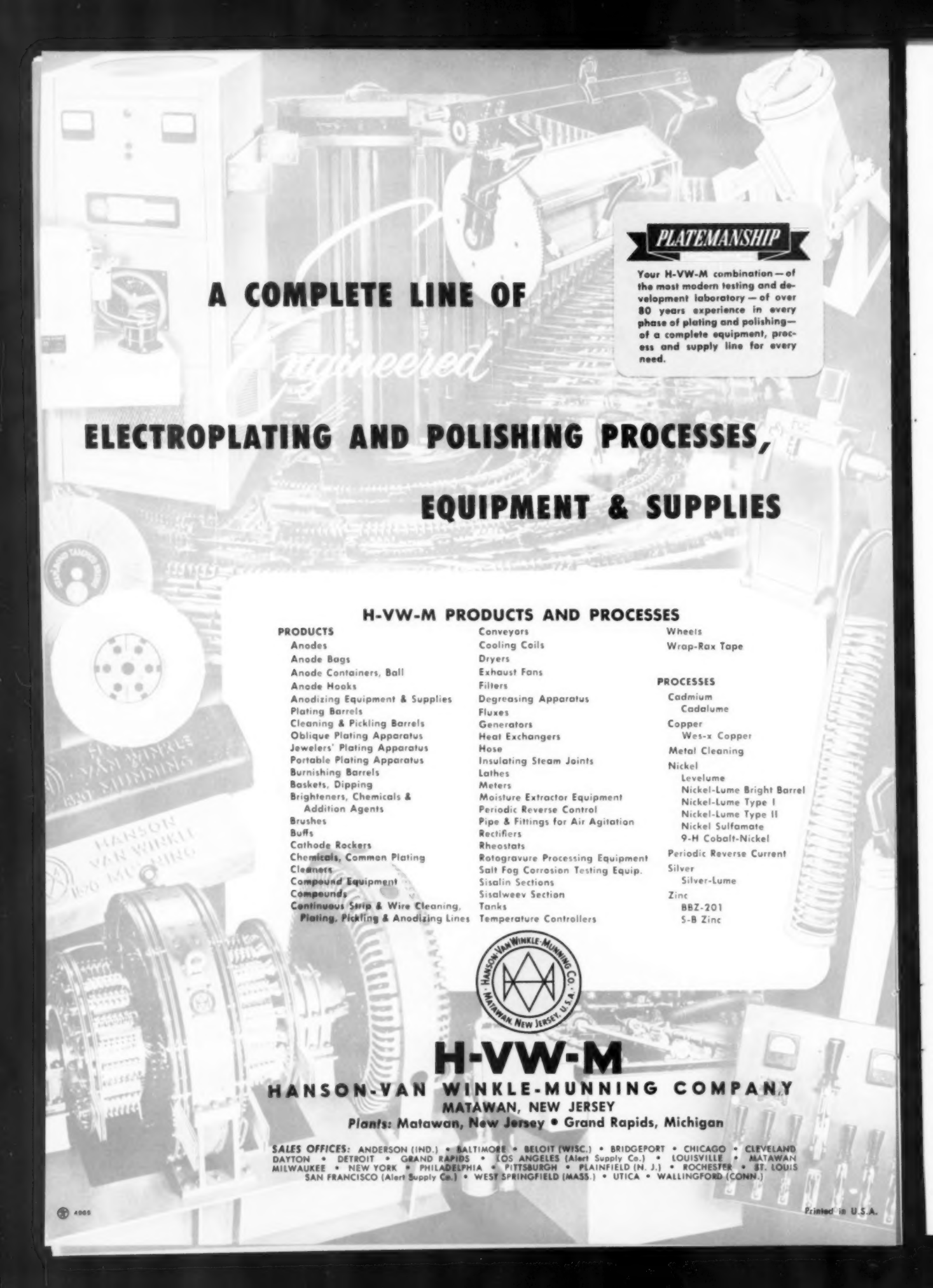

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**AES Project No. 15**

## ACCELERATED CORROSION TESTS

**Project Chairman—**
**W. A. PINNER**
Chairman
Detroit, Michigan
Area

Project No. 15, "Accelerated Corrosion Tests," is being conducted in the Detroit area by a committee chairmanned by Walter L. Pinner.

Specific instructions for the operation of the acetic acid salt spray test and the Corrodkote test were published,[1] because the variations used by several people seemed to be creating some confusion in the industry. These two accelerated corrosion tests are becoming increasingly useful for quality control purposes of copper-nickel-chromium plated parts.

A third test is presently under development. This is a modification of the acetic acid salt spray by addition of copper salts. When copper salts ($CuCl_2 \cdot 2H_2O$) are present at a concentration of 300 ppm of metallic copper and a temperature of 120F, corrosion results can be obtained at four to eight times the rate of the regular acetic acid salt spray test. Details of the correct procedure for conducting this test are being determined.

**REFERENCE**

[1]Plating, **44**, n. 7, pp. 763–766, 1957.

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**AES Project No. 16**

## MECHANISM OF ELECTRODEPOSITION

Project No. 16, "Mechanism of Electrodeposition," is a research program of a fundamental nature. This project, at the University of Pennsylvania, is under the guidance of the Project Director, Dr. J. O'M. Bockris, and the Research Fellow is Michio Enyo.

The use of silver surfaces in silver perchlorate solutions produced data which, when analyzed, gave rise to a fairly detailed picture of the processes occurring at the interface. Information regarding ionic diffusion across the electrode surface has been obtained.

A report of the work of this project has been written and submitted to the Research Committee for approval and publication.

**Project Director—**
**J. O'M. BOCKRIS**
University of
Pennsylvania

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**AES Project No. 17**

## MICROTHROWING POWER

**Project Director—**
**H. LEIDHEISER JR.**
Virginia Institute
for Scientific
Research

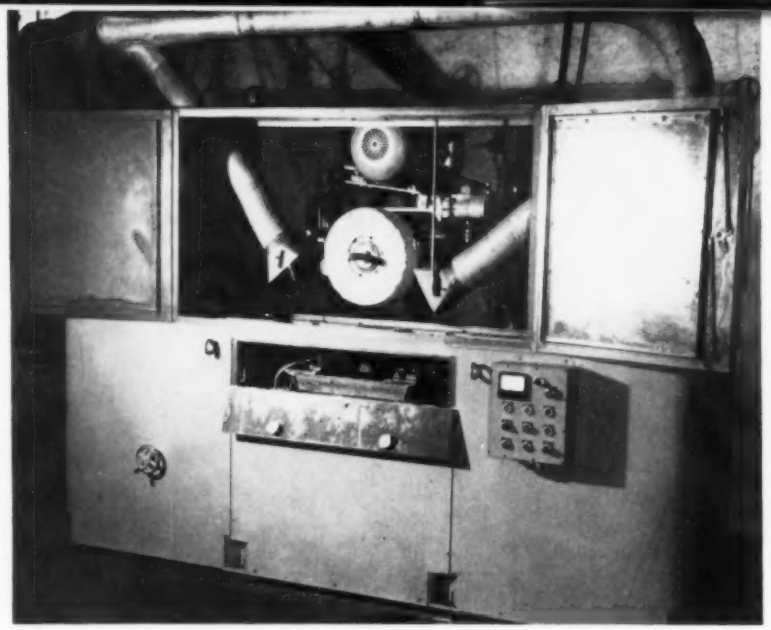
Project No. 17, "Microthrowing Power," is conducted by Dr. Henry Leidheiser Jr., Project Director, and Mrs. Lucille B. Garmon, Research Associate, at the Virginia Institute for Scientific Research.

Both fundamental and applied research are required in studying microthrowing power. The development of a practical tool for measuring this property of plating solutions was necessary before experimental data could be obtained; this has been accomplished and qualitative measurements made on a variety of solutions to test the method and to select the baths for quantitative studies. Data from these experiments are expected to have practical significance that is directly useful to the plater.

To increase our knowledge of the phenomenon of microthrowing power will require fundamental studies somewhat along the lines of Project 16. This phase of the work will be more time-consuming.

**REFERENCE**

AES Research Report, Serial No. 37.



View of the buffing machine built especially for the work on Project 18. It is equipped with the following features: (1) The buffing head can be operated with a constant predetermined pressure. (2) Table speed and direction can be controlled. (3) Wheel speed and direction can be controlled. (4) Speed of the lateral motion of the wheel can be controlled. (5) An ammeter is provided to measure the drag on the wheel.

**AES Project No. 18**

# MECHANICAL FINISHING OF METAL SURFACES

**W. C. GEISSMAN**
President
Rockford Branch

Project No. 18, "Mechanical Finishing of Metal Surfaces," is the newest project of the research program. The special buffing machine built for this project is located at the National Lock Company, and the work is under the guidance of William Geissman with K. Gatchel as the Research Fellow.

A literature search, which has been completed, showed a lack of quantitative information on the subject of buffing and polishing. As a result of surveys, the first experimental work will be a study of the buffing of die castings. There are many variables involved in this phase of the work. For example, in a buffing wheel such things as cloth type, thread count, cloth weight, twist, cut, fiber length, design and density, and wheel size are variables that will be studied.

The results of this investigation should be extremely valuable to practically everyone in the plating industry.

## RESEARCH REPORTS CURRENTLY AVAILABLE FROM AES HEADQUARTERS

**Cleaning and Preparation of Metals for Electroplating, IV, V, VI & VII**—By H. B. Linford & E. B. Saubestre — *Serial 26, Project 12* — **$3.50**

**Methods for Testing Thickness of Electrodeposits, II & III**—By H. J. Read & F. R. Lorenz — *Serial 27, Project 7* — **$1.35**

**Porosity of Electrodeposited Metals**—By N. Thon, D. G. Kelemen, L. Yang, S. Yang, D. Dean — *Serial 28, Project 6* — **85 Cents**

**The Analysis of Electroplating Solutions for Major Constituents**—By E. J. Serfass & M. H. Perry — *Serial 29, Project 2* — **90 Cents**

**Effect of Basis Metal Condition on Plating, I & II**—By A. E. R. Westman & F. A. Mohrnheim — *Serial 30, Project 14* — **$1.10**

**Effect of Surface Finishing of Nonferrous Base Metals on Protective Value of Plated Coatings**—By G. J. Kahan, W. W. Macchia, J. M. Fairbank — *Serial 31, Project 4* — **45 Cents**

**Effect of Impurities and Purification of Electroplating Solutions, VII & VIII**—By D. T. Ewing, J. K. Werner, A. A. Brouwer, C. J. Owen and W. O. Dow — *Serial 32, Project 5* — **$1.00**

**How the Small Electroplater Can Treat Cyanide Plating Waste Solutions with Hypochlorites**—By Barnett F. Dodge and Walter Zabban, Yale University, New Haven, Connecticut — *Serial 33, Project 10* — **50 Cents**

**Effects of Impurities and Purification of Electroplating Solutions, IX, X & XI**—By Dr. D. T. Ewing, Dr. A. J. Smith & Dr. W. O. Dow — *Serial 34, Project 5* — **50 Cents**

**Cleanability and Oil Spreading Rates**—By H. B. Linford & P. E. Grubb — *Serial 35, Project 12* — **50 Cents**

**The Nature, Cause and Effect of the Porosity in Electrodeposits, I & II**—By Fielding Ogburn, Asaf Benderly and Margaret Hilkert — *Serial 36, Project 13* — **$1.00**

**Microthrowing Power, A Literature Search**—By Esther B. Leffler and Henry Leidheiser Jr. — *Serial 37, Project 17* — **75 Cents**

**The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating IV**—By M. H. Jones, Chih-Yeu Lu and J. Zaidowski — *Serial 38, Project 14* — **$1.25**

# CLEANING AND PREPARATION OF METALS PRIOR TO ELECTROPLATING:

## Effect of Oxide Films

### X. EXPERIMENTAL RESULTS

by DR. HENRY B. LINFORD† and DAVID O. FEDER‡

The results of this study of plating nickel on oxidized copper are given in this report. Oxides containing up to 2900 $\mu g/dm^2$ of oxygen (equivalent to a thickness of about 4000 Å of $Cu_2O$) were applied to degreased and hydrogen reduced copper surfaces. Nickel was plated from a high pH Watts bath without allowing contact with air. Part of the oxide was dissolved chemically, part was electrochemically reduced, and when sufficient oxide was on the sample prior to introduction into the plating bath, oxide remained under the nickel plate.

### INTRODUCTION

A METAL READY FOR PLATING usually enters the plating bath with some inorganic contaminants, especially oxide, on its surface. Since this oxide often causes substandard plates, Research Project No. 12 has been studying the effects of electroplating onto metal surfaces contaminated by oxide films.[1] In particular, the project is attempting to elucidate the mechanism by which plating occurs onto such an oxide-soiled cathode. Several mechanisms appear possible:

1. The oxide is covered by the plated metal and remains intact under the plate.
2. The oxide is reduced, chemically or electrochemically, during the plating process.
3. The oxide is dissolved by the plating bath.
4. The oxide is mechanically displaced during the plating operation.

Needless to say, it is recognized that the particular system under consideration will influence which mechanism occurs. This report deals with the results obtained in plating nickel from a Watts type plating bath onto oxidized copper cathodes.

### EXPERIMENTAL METHOD

Previous publications[1] have described details of construction of the equipment necessary to study the results of electroplating on oxide-soiled basis metals. Essentially, the equipment consisted of a three-compartment dry-box, designed so that all experimental work could be conducted in a helium atmosphere substantially free of moisture and oxygen. One compartment contained vacuum-furnace equipment for the preparation of clean (oxide free) metal specimens and for controlled oxidation of these specimens. One compartment contained a plating tank enclosed in a gas-tight container. The third compartment housed a microbalance. Auxiliary equipment maintained the dry, oxygen-free atmosphere.

### DETAILED PROCEDURE

**1. Description of Specimen:**

The specimen was a tube of copper 3½ inches (8.9 cm) long, ⅞ inch (2.2 cm) i.d., with a wall thickness of about 0.003 inch (0.0076 cm). The specimen size was so chosen as to provide sufficient surface area to enable the microbalance to detect a monolayer of oxygen (3 $\mu g/dm^2$). At the same time, a total specimen weight of $<5$ g was required so as to be handled by the balance without appreciable loss of sensitivity. This large surface area (1.25 $dm^2$), coupled with the small total weight, accounted for the thinness of the tubing used.

These specimens were prepared from cold drawn copper tubing with 0.012 inch (0.0305 cm) wall.* The tubes were cut to approximate length, alkaline cleaned, and then etched anodically in a 5 per cent aqueous sulfuric acid solution until the wall thickness had been reduced to approximately 0.003 inch

† Director of AES Project No. 12, Professor of Chemical Engineering, Columbia University, New York, N. Y.

‡ Member, Technical Staff, Bell Telephone Labs., Murray Hill, N. J.

* Courtesy American Brass Co., Waterbury, Conn.

(0.0076 cm). The specimen was then cut to exact size.

Subsequent cleaning consisted of the following steps designed to remove water soluble and organic contaminants and the bulk of surface oxide and produce a specimen which in all cases would pass the atomizer test.[2]

a. Aqueous 3–5 per cent hydrogen peroxide boil to remove organic contaminants.
b. Hot 2–3 per cent $H_2O_2$ made slightly ammoniacal with aqueous ammonium hydroxide to remove tarnish films.
c. Tap water rinse.
d. Rinse in recirculating, de-ionized water ($\simeq$0.1 μmho) for 5–10 min.
e. Dry in air oven at 150C.
f. Anneal and reduce surface oxides in dry, oxygen-free hydrogen at 700C for 15 min.
g. Store in clean, glass tube sealed with ungreased, standard taper, ground joint cap.

**2. Outgassing and Oxide Reduction:**

The copper specimen was placed in vacuum apparatus heated, outgassed, and reduced with hydrogen. After several cycles to insure freedom from oxides, the system was re-evacuated and helium admitted to break the vacuum. The cleaned specimen was then transferred to the microbalance and weighed. Detailed conditions of vacuum treatment are shown in Table I.

**3. Soiling with Oxide:**

After weighing, the clean specimen was again placed in the vacuum equipment and outgassed. Oxygen was then admitted at a definite temperature and pressure and for a predetermined time. Variation of the oxygen pressure, temperature, and time of oxidation allowed varying thicknesses of oxide to be formed. The system was evacuated, helium admitted, and the specimen transferred to the microbalance and reweighed. The weight difference from No. 2 above determined the amount of oxide formed. Other workers have found oxide films on copper in this thickness range to be composed primarily of cuprous oxide[3, 4, 5, 6, 7] A recent electron diffraction study indicates that oxides formed under conditions similar to ours are completely converted to cuprous oxide during cooling in vacuo.[8] In addition, material balances obtained during blank runs described below indicate that the oxide was primarily cuprous in nature. Detailed conditions of the vacuum treatment are shown in Table I, and oxidation data in Table II.

**4. Plating:**

After weighing, the oxide-coated specimen was transferred to the plating tank. The tank was evacuated, nickel solution admitted under partial vacuum and the specimen allowed to soak four minutes until boiling (under the reduced pressure) had ceased. This pre-plating soak generally is not recommended plating practice. However, due to the restrictive conditions imposed by our equipment, a long enough soak period was established so that reproducible experimental conditions could be maintained. Nickel plating was then begun and continued until approximately 18 coulombs had been passed. The solution was then drained from the tank, distilled water admitted, under vacuum, and the specimen rinsed by soaking for five minutes. Tank helium bubbling through the water provided agitation during this rinsing operation. This rinse cycle was repeated three times after which the last batch of water was drained and the specimen rough dried under fore-pump vacuum with a liquid nitrogen trap. Dry-box helium was then admitted, the plating tank opened and the specimen transferred to the high vacuum system for vacuum drying. Detailed conditions of vacuum drying are shown in Table I. After treatment, the vacuum was broken by the admission of helium and the dry specimen transferred to the microbalance and reweighed.[1] The weight difference from No. 3 above determined the weight change during plating.

**5. Coulometry:**

A copper coulometer utilizing a platinum cathode[9] was connected in series with the plating cell. After the plating cycle had been completed, the coulometer was disconnected from the plating cell, the polarity of the coulometer electrodes reversed, and the copper previously deposited stripped at constant current. A sharp voltage inflection occurred at the point of complete copper removal and served as a convenient end-point indicator for the system. The product of elapsed time times stripping current determined the total coulombs passed during the plating cycle. Constant currents were supplied by an Electronic Research Associates constant current generator* and were measured by determining the voltage drop through a 1 ohm precision resistor (Leeds & Northrup #775 resistance box) by

TABLE I

CONDITIONS FOR VARIOUS VACUUM TREATMENTS OF COPPER SPECIMENS

| Treatment | Pressure | Temperature °C | Time, Min. |
|---|---|---|---|
| 1. Outgassing, before $H_2$ reduction | $<5 \times 10^{-5}$ mm Hg | 500 | Variable |
| 2. Hydrogen reduction | 1 mm Hg | 500 | 45–90 |
| 3. Outgassing after $H_2$ reduction | $2–5 \times 10^{-5}$ mm Hg | @ 500 | Variable |
| Ultimate vacuum | $3 \times 10^{-7}$ to $1 \times 10^{-6}$ mm Hg | 30 | |
| 4. Outgassing before oxidation | $<6 \times 10^{-6}$ mm Hg | @ 30, 100, 170 oxidation T | Variable |
| | $<2 \times 10^{-5}$ mm Hg | @ 500, oxidation T | |
| 5. Oxidation | $\simeq$1 mm Hg | 30, 100, 170, 500 | 30 |
| 6. Outgassing after oxidation | $<6 \times 10^{-6}$ mm Hg | @ oxidation T 30, 100, 170 | Variable |
| | $<2 \times 10^{-5}$ mm Hg | @ 500, oxidation T | |
| Ultimate vacuum | $3 \times 10^{-7}$ to $2 \times 10^{-6}$ mm Hg | @ 30 | |
| 7. $H_2O$ bake after plating | $<6 \times 10^{-6}$ mm Hg | 220–270 | 10–22 hr |
| Ultimate vacuum | $4 \times 10^{-7}$ to $1.5 \times 10^{-6}$ mm Hg | 30 | |

* Courtesy Bell Telephone Laboratories, Inc., Murray Hill, N. J.

means of a Leeds & Northrup Type K potentiometer. An electric timer (Precision Scientific Co.) activated by a microswitch thrown simultaneously with the stripping current microswitch served to measure elapsed time.

Approximately 200 blank runs were made with a miniature coulometer cell so designed that plating and stripping current densities (1–50 asf) corresponding to those to be used in the full scale set-up could be supplied by the constant current generator's 250 ma maximum output. Pertinent results of these runs are shown in Table III.

**6. Nickel Analysis:**

After final weighing, the specimen was placed in a clean ground glass capped bottle and removed from the dry-box for analysis of nickel deposited during plating. Analysis consisted of dissolving the sample in $HNO_3$, dilution to 100 ml and removal of three weighed aliquots. Copper was separated electrolytically. The solution remaining after electrolysis was evaporated down to less than 100 ml, treated with citric acid, iodine-potassium iodide solution, ammonium hydroxide and finally dimethylglyoxime to develop the red dimethylglyoxime complex.[10] The sample was then accurately diluted to 250 ml and the per cent transmission measured at 530 mμ with a Beckman Model B spectrophotometer. The amount of nickel present was determined from a previously established calibration curve. Results of blank runs are shown in Table IV.

**7. Blank Runs:**

A series of blank runs was made to insure that at no point during the experimental procedure would the specimens show unaccountable weight changes.

The experimental procedure may be broken down as follows:

a. Hydrogen reduction in vacuum system.
b. Weighing in dry-box.
c. Oxidation in vacuum system.
d. Weighing in dry-box.
e. Soaking in nickel solution.
f. Nickel plating.
g. Rinsing.
h. Drying in vacuum system.
i. Weighing in dry-box.

The following series of blank runs was necessitated by the above procedure:

1. Weight gain of clean (reduced) specimen in dry-box atmosphere.
2. Weight gain of oxidized specimen in dry-box atmosphere.

**TABLE II**
**OXIDATION RESULTS**
**(Spec. area 1.25 dm²)**

| Run No. | Oxidation | | | Weight Gain | Approx. Thickness, |
|---|---|---|---|---|---|
| | $P_{O_2}$ mm Hg | θ Min. | T°C | μg | Å |
| 21 | 0.8 | 30 | 30 | 10 | 12 |
| 22 | ↓ | ↓ | ↓ | 12 | 14 |
| 23 | ↓ | ↓ | ↓ | 15 | 18 |
| 24 | ↓ | ↓ | ↓ | 28 | 33 |
| 25 | ↓ | ↓ | ↓ | 9 | 11 |
| 26 | ↓ | ↓ | ↓ | 12 | 14 |
| 27 | ↓ | ↓ | ↓ | 5 | 6 |
| 31 | 0.6 | 30 | 100 | 42 | 50 |
| 60 | 0.5 | ↓ | ↓ | 65 | 78 |
| 70 | 0.4 | ↓ | ↓ | 39 | 47 |
| 74 | 0.9 | ↓ | ↓ | 46 | 55 |
| 79 | 0.4 | ↓ | ↓ | 153 | 182 |
| 83 | 0.6 | ↓ | ↓ | 75 | 90 |
| 30 | 0.4 | 30 | 165 | 845 | 1010 |
| 32 | 0.6 | ↓ | 170 | 352 | 420 |
| 33 | 0.5 | ↓ | 170 | 926 | 1105 |
| 39 | 0.6 | ↓ | 170 | 875 | 1040 |
| 42 | 0.7 | ↓ | 196 | 428 | 510 |
| 58 | 0.5 | ↓ | 186 | 475 | 568 |
| 59 | 0.6 | ↓ | 183 | 426 | 509 |
| 69 | 0.5 | ↓ | 181 | 862 | 1030 |
| 72 | 0.4 | ↓ | 184 | 482 | 575 |
| 80 | 0.6 | ↓ | 150 | 797 | 952 |
| 82 | 0.6 | ↓ | 150 | 686 | 820 |
| 28 | 0.8 | 30 | 504 | 2045 | 2440 |
| 29 | 0.8 | ↓ | 516 | 2529 | 3020 |
| 37 | 0.6 | ↓ | 536 | 2139 | 2550 |
| 43 | 0.6 | ↓ | 580 | 2069 | 2470 |
| 44 | 0.6 | ↓ | 578 | 2125 | 2540 |
| 48 | 0.4 | ↓ | 554 | 2066 | 2460 |
| 49 | 0.4 | ↓ | 556 | 2067 | 2460 |
| 54 | 0.7 | ↓ | 546 | 1900 | 2260 |
| 55 | 0.6 | ↓ | 546 | 1996 | 2360 |
| 56 | 0.5 | ↓ | 546 | 1933 | 2300 |
| 57 | 0.3 | ↓ | 538 | 1934 | 2300 |
| 68 | 0.4 | ↓ | 532 | 1707 | 2040 |
| 71 | 0.3 | ↓ | 570 | 1596 | 1900 |
| 75 | 0.9 | ↓ | 542 | 3619 | 4330 |
| 78 | 0.7 | ↓ | 185 | 2169 | 2590 |

**TABLE III**
**COULOMBS PASSED DURING PLATING vs. COULOMBS MEASURED BY STRIPPING**

| Temp. °C | No. of Expts. | Total Coulombs | C.D. in amps/ft² | | Per Cent Error* | σ Per Cent of mean |
|---|---|---|---|---|---|---|
| | | | Plating | Stripping | | |
| 27 | 5 | 8 | 49 | 2 | −0.01 | ±0.22 |
| 27 | 5 | 15 | 49 | 2 | −0.27 | ±0.32 |
| 5–21 | 5 | 15 | 49 | 2 | −10.3 | ±5.4** |
| 27 | 5 | 8 | 11 | 2 | +0.25 | ±0.26 |
| 28 | 5 | 16 | 11 | 2 | −0.03 | ±0.16 |
| 5 | 5 | 17 | 11 | 2 | −0.14 | ±0.15 |
| 9 | 4 | 9 | 11 | 2 | −0.27 | ±0.20 |
| 29 | 3 | 3.5 | 11 | 11 | −0.34 | ±0.16 |
| 5–9 | 3 | 3.5 | 11 | 11 | −0.33 | ±0.40 |

* Minus indicates more coulombs used in plating than in stripping cycle.
** This is a condition of temperature and current density which was not used in this study.

TABLE IV

COLORIMETRIC NICKEL ANALYSIS—ACCURACY AND PRECISION DETERMINATION

| Sample | Aliquot | Nickel in Sample μg | Copper Added to Sample g | Nickel Found in Sample μg | Error (Sample) μg | Average Error μg | σ μg | Average Per Cent Error | σ Av. Per Cent of Mean |
|---|---|---|---|---|---|---|---|---|---|
| C-2 | A | 5328 | — | 5265 | −63 | | | | |
| | B | 5328 | — | 5340 | +12 | −12 | ±34 | −0.23 | ±0.64 |
| | C | 5328 | — | 5326 | −2 | | | | |
| | E | 5328 | — | 5330 | +2 | | | | |
| | F | 5328 | 3.5 | 5291 | −37 | | | | |
| | G | 5328 | 3.5 | 5325 | −3 | −8 | ±26 | −0.15 | ±0.49 |
| | H | 5328 | 3.5 | 5343 | +15 | | | | |
| C-3 | A | 5938 | 3.3 | 6021 | +83 | | | | |
| | B | 5938 | 3.3 | 6016 | +78 | +69 | ±21 | +1.28 | ±0.4 |
| | C | 5938 | 3.3 | 5985 | +47 | | | | |
| Run No. 63 (unoxidized sample, plated in dry-box) | A | 2767 | 2.2147 | 2699 | −68 | | | | |
| | B | 2767 | 2.2147 | 2684 | −83 | −51 | ±43 | −1.9 | ±1.5 |
| | C | 2767 | 2.2147 | 2765 | −2 | | | | |

3. Change in weight of reduced specimen after immersion in rinse water (distilled), followed by vacuum drying (bake-out).
4. Change in weight of reduced specimen after immersion in plating solution, followed by rinsing in distilled water and vacuum drying.
5. Change in weight of oxidized specimen (several oxide thicknesses) after immersion in rinse water followed by vacuum drying.
6. Change in weight of oxidized specimen (several oxide thicknesses) after immersion in nickel plating solution, followed by rinsing in distilled water and vacuum drying.

The results of these blank runs are shown in Tables V to VIII and may be summarized as follows:

Except for exposure to Watts nickel bath, weight changes incurred during all steps of the process are negligible ($<20\ \mu g$), provided vacuum drying and baking of rinsed, oxidized specimen is carried out under conditions which allow adequate time for complete water removal but at a temperature low enough to prevent significant evaporation or dissociation of the copper oxide.

In the Watts nickel bath, at *p*H 4.0, both copper oxide and pure copper are soluble. Increasing *p*H to 5.2 causes dissolution of clean copper to become negligible, but copper oxide still dissolves at a rate of about $600\ \mu g/dm^2$/minute without agitation, and at about twice this rate with agitation.

These data indicate that even a high *p*H Watts bath is a rather efficient pickle for copper oxide, and pose a question as to the fate of the copper ions formed by dissolution of the oxide, on subsequent plating. The four-minute preplating soak in Watts nickel bath, described in Section 4, served two functions:

1. To allow vapor bubbles to be detached from the cathode prior to plating (the plating bath entered the tank under vacuum and hence was actually boiling to some extent, under reduced pressure, producing a multitude of bubbles which served to insulate portions of the cathode, leaving a "spotted" appearance after plating).
2. To allow appreciable dissolution of copper oxide, producing a cathode film rich in copper ions and thus provide optimum opportunity for codeposition of this copper with the nickel in the subsequent plating cycle.

## RESULTS

Sixteen plating runs were made at 10 and 50 asf onto copper cathodes with oxide thicknesses varying from less than 3 to 4300 Å. Approximately 18 coulombs were passed, with plating times of the order of 2.5 and 12 sec at 50 and 10 asf, respectively. For the number of coulombs passed, the variation of current efficiency of nickel deposition

$$\left[\frac{\text{wt Ni plated (by analysis)} \times 100}{\text{theoretical wt Ni plated at 100\% C.E. (from coulometer)}}\right]$$

with amount of oxide originally present is shown graphically in Fig. 1 and in tabular form in Table IX.

To obtain insight into the mechanism of nickel deposition and the fate of the oxide during the plating process, the weight of nickel actually deposited must be compared with the weight change of the specimen during the plating cycle. The weight change of the specimen during the plating cycle may be calculated by correcting the observed weight change during the plating and pre-soak cycle for the amount of oxide dissolved during the four-minute soak prior to plating which may be calculated from the blank run data of Table VIII.

An overall material balance for the weight changes occurring during plating may be written as follows:

$$\text{wt change during plating} = \text{wt}_{\text{Ni deposited}} + \text{wt}_{\text{Cu codeposited}} - \text{wt}_{\text{oxygen lost in Cu}_2\text{O reduction during plating}} = \text{wt}_{\text{Cu}_2\text{O dissolved}} - \text{wt}_{\text{Cu}_2\text{O displaced}}$$

**TABLE V**
**WEIGHT GAIN OF CLEAN (REDUCED) SPECIMEN IN DRY-BOX ATMOSPHERE**
**Specimen area = 1.25 dm²**

| Exposure Time hr. | Weight Gain From Time of First Weighing, μg | | | |
|---|---|---|---|---|
| | Run 1 | Run 2 | Run 3 | Run 4 |
| 0.1* | | | | 0 |
| 0.2* | | | 0 | |
| 0.25* | | 0 | | |
| 0.33* | 0 | | | |
| 0.5 | | | −1 | |
| 0.67 | | | | −3 |
| 0.75 | | +5 | | |
| 1.0 | +1 | | | |
| 1.1 | | | +5 | +11 |
| 1.35 | | +11 | | |
| 1.9 | +5 | | | |
| 2.0 | | | +7 | |
| 2.1 | | | | +14 |
| 2.35 | | +5 | | |
| 2.9 | +1 | | | |
| 3.0 | | | +7 | |
| 3.1 | | | | +14 |
| 3.35 | | +9 | | |
| 3.9 | +12 | | | |
| 4.0 | | | +7 | |
| 4.1 | | | | +11 |
| 4.35 | | +12 | | |
| 5.1 | | | | +19 |
| 5.35 | | +14 | | |
| 6.0 | | | | +18 |
| 23.0 | +23 | | | |
| 27.8 | +24 | | | |
| 50.0 | +29 | | | |
| 58.25 | | +114 | | |

* Time of first weighing.

This material balance, in conjunction with consideration of the coulombs passed during the plating cycle, enables a calculation to be made of the secondary electrode processes which are taking place under these conditions, with the addition of two assumptions:

(1) That no hydrogen evolution occurs.

(2) There is no appreciable dissolution or displacement of oxide during the plating process.

When this calculation has been made (see Appendix for details), the following equations are obtained:

$$\text{wt oxygen lost by electrochemical reduction of } Cu_2O = 329.38\left[\begin{matrix}\text{Coulombs}\\ \text{Total}\end{matrix} - \begin{matrix}\text{Coulombs}\\ \text{Nickel}\end{matrix}\right] - \left[\begin{matrix}\text{wt change}\\ \text{during plating}\end{matrix} - \begin{matrix}\text{wt nickel}\\ \text{deposited}\end{matrix}\right]$$

$$5.012$$

Also:

$$\text{wt}_{\text{copper codeposited}} = \text{wt}_{\text{oxygen lost in } Cu_2O \text{ reduction}} + \text{wt change during plating} - \text{wt}_{\text{nickel deposited}}$$

and

$$\text{wt oxygen remaining on specimen after plating} = \text{initial wt oxygen uptake} - \text{wt}_{\text{oxygen lost in } Cu_2O \text{ dissolved during soak}} - \text{wt}_{\text{oxygen lost in } Cu_2O \text{ reduction during plating}}$$

Results of these calculations are tabulated in Tables IX and IX-a, and plotted versus amount of oxide originally present in Figs. 2, 3, and 4.

The fraction of the current used for each electrode process, i.e., nickel deposition, copper codeposition, and oxide reduction, is plotted versus oxide thickness in Fig. 5.

Since the validity of these results is determined by the accuracy of the assumptions made in deriving the necessary equations, it is of interest to examine these assumptions more critically.

1. Weight changes during plating do not involve either oxide dissolution or mechanical displacement of oxide.

There are available no data to suggest that the oxides formed in this study were loosely adherent. On the contrary, preliminary adhesion data obtained in a study currently under way for Project 12[11] indicate that the oxides are tenaciously held and extremely difficult to displace from the copper basis metal. Other workers[12, 13] have also found oxides in this thickness range to be adherent.

Oxide dissolution during plating is, of course, a possibility, but several factors mitigate its influence. In the worst case, total plating times were of the order of 12 sec duration, followed by immediate drainage of plating solution from the system. Assuming that the application of a negative (cathodic) potential to the oxide will not enhance oxide dissolution, the total weight loss by oxide dissolution during these 12 sec may be calculated from Table VIII to be of the order of 100–120 μg. However, within the first few fractions of a second

**TABLE VI**
**WEIGHT GAIN OF OXIDIZED SPECIMENS IN DRY-BOX ATMOSPHERE**
**Specimen area = 1.25 dm²**

| Exposure Time hr. | Weight Gain From Time of First Weighing, μg | |
|---|---|---|
| | Run 21 | Run 22 |
| 0 | | |
| 0.1* | 0 | 0 |
| 0.5 | +2 | +2 |
| 1.5 | −6 | +2 |
| 2.5 | +9 | +11 |
| 3.5 | | +6 |
| 3.75 | +5 | |
| 4.25 | | +6 |
| 4.75 | 0 | |

**Note:** Both specimens oxidized at 30°C for 30′, producing an oxide film weighing 14 μg (oxygen uptake).

* Time of first weighing.

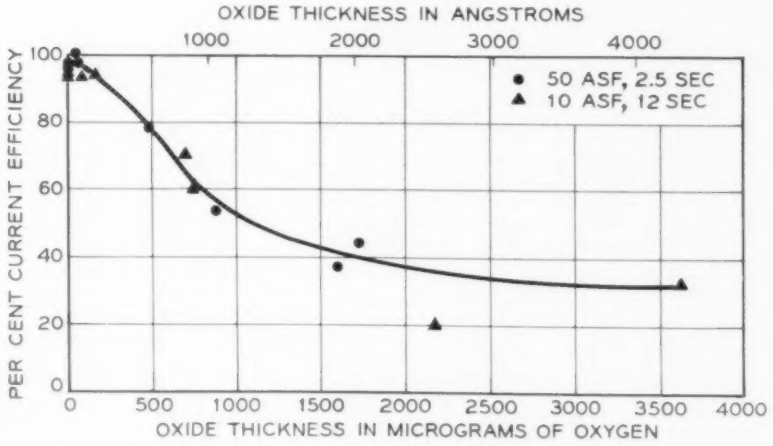



**Fig. 1** Effect of oxide thickness on current efficiency of nickel deposition

after plating commences, the oxide surface will be covered to some extent by the depositing metal (approximately 0.2 sec for ≃ 1 atom layer of nickel). Hence, the time during which the oxide actually is in contact with the Watts bath will be only a small fraction of the actual plating time, perhaps 1 or 2 sec at most. During this short time, at most 10–20 μg of oxide could disolve, and this is well within the limits of experimental error. If oxide dissolution during plating were to cause a detectable error in these calculations, one might expect the results for the low current density runs (≃12 sec plating time) to show more error than those for the high current density (2½ sec total plating time) for several reasons:

1. Plating time for low current density runs were approximately five times as long as for the high current density runs allowing oxide to be exposed to the solution for considerably longer times at the conditions of low current density.
2. Modern theories of electrodeposition[14] suggest that nickel deposition initially occurs at discrete surface sites and continues to do so until individual tetrahedra are built up on the basis surface. At low current densities, deposition will occur at relatively few sites and a longer time for coverage will be required than for the high current density case when deposition will commence at many sites.

No correlation between current density and error appears to exist in the curves of Figs. 2, 3 and 4. On these bases, therefore, we may conclude that a proper material balance for the system during plating involves only oxide reduction, nickel deposition and copper codeposition.

The second assumption, that no appreciable hydrogen evolution occurs where any appreciable dissolved copper is present, may be fortified by calculation of the equilibrium deposition potentials and ion activities required for hydrogen evolution at the *p*H of the nickel bath. Since the dissolved copper will be concentrated primarily in the cathode film the probability of hydrogen evolution is materially reduced. When oxide was dissolved during the soak period, under the conditions studied, calculations indicate that in no case was all the copper ion removed from the cathode film during plating.

TABLE VII

WEIGHT CHANGES OF CLEAN OR OXIDIZED SPECIMENS AFTER IMMERSION IN DISTILLED $H_2O$ AND VACUUM BAKEOUT

(Spec. area = 1.25 $dm^2$)

| Run No. | Weight of Oxide Film, μg (Oxygen uptake) | Time of Immersion in Distilled $H_2O$ min. | Conditions of Vacuum Bakeout hr. | T°C | Weight Change μg |
|---|---|---|---|---|---|
| 6 | — | 5 | 1 | 350 | +1 |
| 7 | — | 5 | 1 | 〃 | −4 |
| 8 | — | 5 (aerated) | 1 | 〃 | +15 |
| 23 | 15 | 20 | 1 | 350 | +12 |
| 24 | 28 | 20 | 1 | 350 | +48 |
| 25 | 9 | 20 | 1 | 350 | −37 |
| 26 | 12 | 20 | 1 | 350 | −9 |
| 27 | 5 | 20 | 1 | 350 | −3 |
| 31 | 42 | 20 | 1 | 350 | −41 |
| 28 | 2045 | 20 | 1 | 350 | −117 |
| 29 | 2529 | 20 | 1 | 350 | −93 |
| 30 | 845 | 20 | 1 | 350 | −115 |
| 32 | 352 | 0 | 1 | 350 | −48 |
| | | Then 20 | 1 | 350 | −194 |
| 33 | 926 | 20 | 0.75 | 140 | +272 |
| | | Then re-baked | 1 | 230 | +51 |
| | | Then re-baked | 1 | 230 | +15 |
| | | Then re-baked | 1 | 230 | 0 |
| 34 | — | 20 | 2.5 | 230 | +32 |
| | | re-bake | 1 | 230 | +27 |
| 35 | — | 20 | 3.5 | 230 | +15 |
| 36 | 8 | 20 | 3.5 | 230 | +21 |
| 37 | 2139 | 20 | 1.75 | 280 | −7 |
| | | re-bake | 1 | 280 | −24 |
| 38 | — | 20 | 1.75 | 280 | +9 |
| 39 | 875 | 20 | 1.75 | 280 | −53 |
| 40 | — | 20 | 16 | 216 | +47 |
| 41 | — | 20 | 21 | 240 | +5 |
| Then oxidized | 108 | 20 | 23.5 | 240 | −7 |
| 42 | 428 | 20 | 11 | 244 | −9 |
| 43 | 2069 | 20 | 12.5 | 240 | −20 |
| 44 | 2125 | 20 | 21 | 240 | −20 |
| 46 | — | 20 | 12.5 | 240 (?) | +28 |
| 47 | — | 20 | 12 | 234 | +21 |

## DISCUSSION OF RESULTS

Fig. 1 shows clearly that as the oxide thickness increases, the current efficiency of nickel deposition falls off in continuous fashion and at initial oxide thicknesses of about 4300 Å has dropped to approximately 30 per cent current efficiency when 20 coulombs have been passed. These data indicate that one or more secondary electrode processes assume increasing importance with increasing thickness of the oxide film. They also indicate that a five-fold increase in current density appears to be without significant effect.

The probable nature of these secondary electrode processes is indicated by the curves of Figs. 2, 3 and 4. Here, we see that both codeposition of dissolved copper ion and electrochemical reduction of the remaining oxide consume an increasing share of the available current as oxide thickness increases, approaching an asymptotic value at initial oxide

thicknesses of approximately 2000 Å. These curves indicate, therefore, three major electrode processes operating under these conditions:

1. Nickel deposition
2. Electrochemical reduction of $Cu_2O$
3. Codeposition of dissolved copper ions, formed by soaking oxidized specimen in plating solution prior to plating

More light on the nature and importance of each of these processes may be gained by considering four regions of oxide thickness, i.e.,

1. up to 350 Å
2. from 350–1000 Å
3. from 1000–2000 Å
4. greater than 2000 Å

Under the conditions employed, all the oxide present in films <350 Å thick was probably dissolved in the four minute preplating soak period. For films of this thickness, therefore, only two mechanisms are possible: nickel deposition and copper codeposition. Table X shows how the actual weight gain during plating (corrected for oxide dissolution prior to plating) compares with weight of copper codeposited calculated by assuming all current not used in nickel plating is used for codeposition of copper. The agreement is rather good and indicates the essential correctness of the assumptions as to electrode processes.

For films from 350–1000 Å, Fig. 4 indicates that the combined processes of oxide dissolution during the pre-soak period and oxide reduction during plating have removed all the oxide present, and the plated specimen is essentially oxide-free. Hence, depending on the oxide thickness, varying numbers of coulombs are required to reduce the oxide present, and a steady state condition is not reached until all the oxide is gone. Under these conditions, all three electrode processes are operating, either simultaneously or consecutively, until all the oxide has been reduced. Following this, two processes—nickel and copper deposition—continue to occur for the duration of the plating period. Presumably, for longer plating times, it would be possible to remove most of the copper from solution.

For oxides thicker than 1000 Å, a steady state condition has been reached (for the number of coulombs passed) with oxide still present on the basis metal. Under these conditions, for oxides thicker than 2000 Å, a constant amount of oxide reduction occurs, producing, as is seen in Fig. 4, an oxide residue, under the plate, directly proportional to the initial oxide film thickness, as indicated by the 45° slope of this portion of the curve. For these thicker films, copper codeposition also appears to have reached a steady state condition, as indicated by the levelling off of the curve in Fig. 3. From 1000–2000 Å, the amount of oxide reduced appears to be a function of oxide thickness, and the amount of oxide remaining after plating therefore depends on this relationship. Fig. 2 shows that the amount of copper oxide reduced does not become constant until 2000 Å; however, Fig. 4 shows that when 1000 Å is exceeded some oxide remains under the plate.

At this point, an attempt should be made to ascertain the reliability of the data. The reproducibility of the various

TABLE VIII

SOLUBILITY DATA

WEIGHT CHANGES OF CLEAN OR OXIDIZED COPPER SPECIMENS AFTER IMMERSION IN WATTS BATH, RINSING IN DISTILLED WATER, FOLLOWED BY VACUUM BAKEOUT

Spec. Area = 1.25 $dm^2$

| | Weight of Oxide Film | | Immersion in Plating Bath | | | | |
|---|---|---|---|---|---|---|---|
| Run No. | Oxygen uptake (meas.) μg | Equiv. $Cu_2O$ (calc.) μg | θ min. | Per Cent of Spec. immersed | pH | Agitation | Weight Change μg |
| 48 | 2067 | 18,491 | 5 | all | 4.0 | yes | −15,376 |
| 49 | 2067 | 18,491 | 5 | all | 4.0 | yes | −16,274 |
| 50 | 1 | 9 | 5 | all | 4.0 | yes | −1,684 |
| 51 | 0. | 0. | 5 | all | 4.0 | no | −440 |
| 52 | 0. | 0. | 5 | all | 5.2 | no | −3 |
| 53 | 0. | 0. | 5 | all | 5.2 | no | −23 |
| 54 | 1911 | 17,096 | 5 | all | 5.2 | no | −3,589 |
| 55 | 2011 | 17,991 | 5 | all | 5.2 | no | −3,207 |
| 56 | 1933 | 17,293 | 5 | all | 5.2 | yes | −7,068 |
| 57 | 1934 | 17,302 | 0.88 | all | 5.2 | no | −555 |
| 58 | 363 | 3,247 | 5 | 58 | 5.2 | no | −2,732 |
| 59 | 359 | 3,212 | 5 | all | 5.1 | no | −2,635 |
| 60 | 65 | 582 | 5 | all | 5.1 | no | −565 |

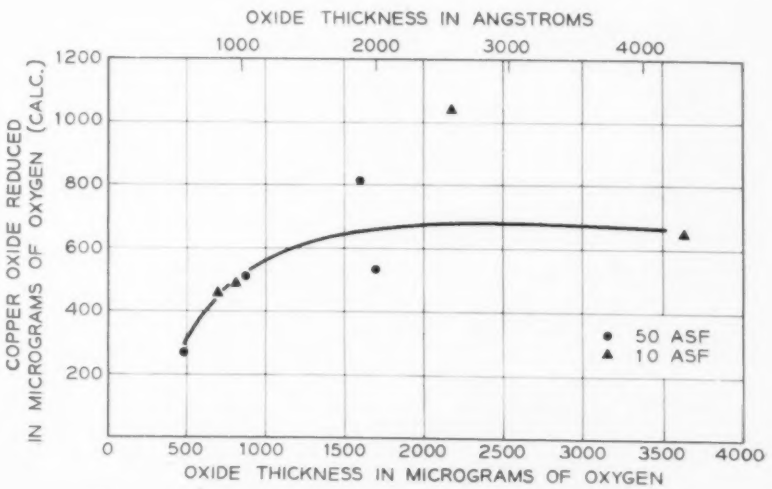



Fig. 2 Effect of oxide thickness on cathodic reduction of copper oxide

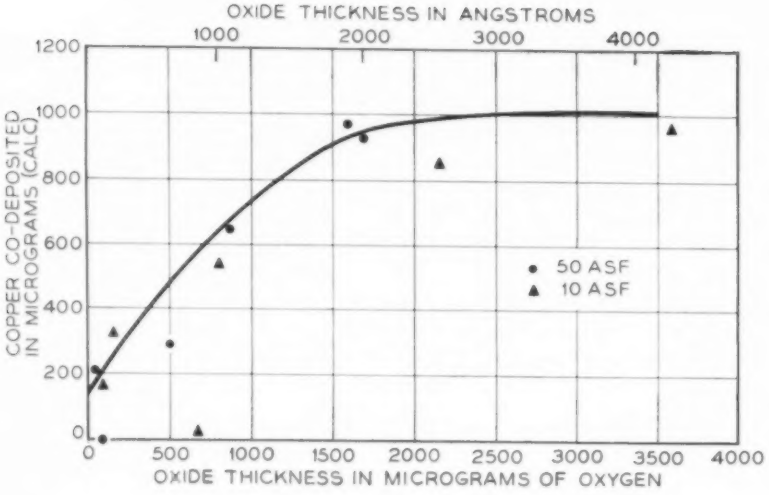



**Fig. 3** Effect of oxide thickness on codeposition of copper

gravimetric determinations is approximately ± 3 μg. Most pertinent are the data for oxide thickness, which are probably good to ± 3 μg, and the weight change during plating, to ± 14 μg. The colorimetric analytical data for nickel show a stand ard deviation of ± 32 μg, while the coulometric data, on the basis of blank runs, show a standard deviation of ± 17 μg. Since only a few points were taken on the solubility curve, it is difficult to obtain a reliable estimate of the precision of these data, but ± 120 μg would be a fair estimate.

In order to have an appreciation of the order of magnitude of these individual errors, it should be pointed out that with the specimen geometry involved a monolayer of cuprous oxide weighs 32 μg, corresponding to a gain in weight, due to oxygen uptake, of 3.6 μg. Likewise, a single atomic layer of plated nickel corresponds to 39 μg. Thus, it may be appreciated that the largest individual errors are of the order of 1 to 4 atomic layers of the reacting species involved.

To obtain an estimate of the error involved in the calculations for codeposited copper, oxide reduced and amount of oxide remaining after plating, it is necessary to apply the appropriate individual errors to equations (6), (9) and (10). When this is done,

Error in amount of oxide reduced electrochemically = ± 26 μg

Error in amount of copper codeposition = ± 128 μg for oxides thicker than 350 Å

Error in amount of copper codeposition = ± 40 μg for oxides <350 Å thick

Error in amount of oxide left after plating = ± 30 μg

These results indicate several problems of significance to platers. In general, we may reasonably expect that any oxide present on specimens entering the plating bath will not be so thick as to be visible. Hence, our discussion should be limited to the region of oxide thickness up to 200 Å (first visible interference color on copper ≃ 190 Å).[15] A glance at Fig. 4 indicates complete removal of any oxides of this thickness by either dissolution during the four-minute soak or by electrolytic reduction. However, this does not mean these thin oxides are of no consequence. On the contrary, poor plating may result under these conditions from either of two circumstances:

1. If the work is placed in the Watts bath without applied potential, the bath will chemically dissolve the oxide, producing a cathode film rich in copper ions which codeposit with the first atomic layer of nickel. Since this copper codeposits from a bath not optimized for copper plating, it could easily cause a weakening of the bond between the basis copper and subsequent nickel deposit.
2. If potential is applied when the work enters the bath, then oxide dissolution will not be significant but oxide reduction will occur—probably producing a skeletal oxide lattice (since the copper atoms may not be able to assume their normal lattice positions before nickel deposition is appreciable) onto which nickel deposition will occur. Here again the all important interface will consist not of nickel atoms positioned on a well ordered copper lattice, but on a skeletalized or strained oxide lattice, which may significantly affect the adherence of the deposit.

To test the significance of both of the above conditions, Project No. 12 is currently collecting quantitative adhesion

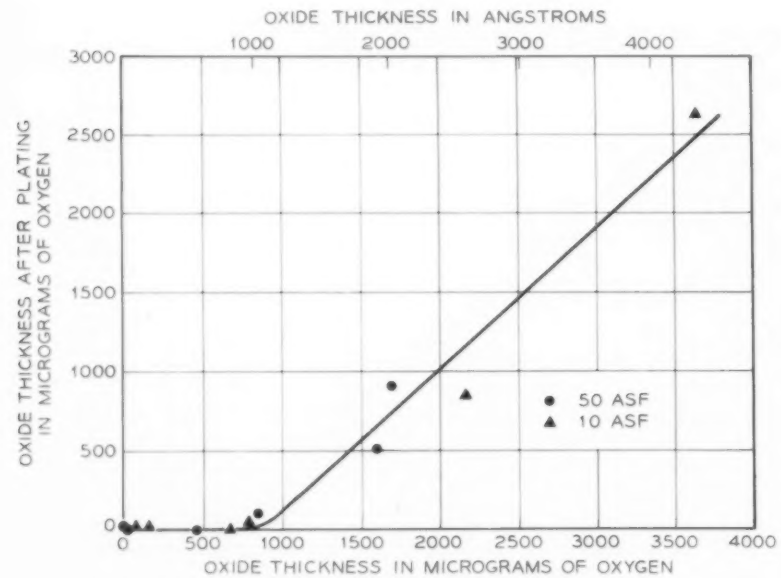



**Fig. 4** Effect of oxide thickness on amount of oxide remaining after plating

## TABLE IX

## RESULTS OF NICKEL PLATING ONTO OXIDIZED COPPER

(Spec. area = 1.25 dm²)

| Run No. | Oxide: Oxygen Uptake μg (F)* | Oxide: Equiv. $Cu_2O$ μg (C + F) | Oxide: Approx. Thickness Å | C.D. of Plating Amp/ft² | Ni Plated (J) (By Anal.) μg | Ni Theor. Plated (K) (Coulometer) μg | Wt. Change During Plating & Soak (L-O) μg | Oxide Dissolved During Soak Prior to Plating (D + G) μg $Cu_2O$ | Wt. Change During Plating Only (L-O) + (D + G) μg | C.E. of Plating (J/K × 100%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 66 | 0 | 0 | 0 | 50 | 5,157 | 5,326 | 5,158 | 0 | 5,158 | 96.8 |
| 67 | 0 | 0 | 0 | 50 | 10,618 | 10,962 | 10,855 | 0 | 10,855 | 96.9 |
| 70 | 39 | 349 | 46 | 50 | 4,077 | 4,054 | 3,399 | 349 | 3,748 | 100.6 |
| 74 | 46 | 412 | 55 | 50 | 5,860 | 6,040 | 5,663 | 412 | 6,075 | 97.0 |
| 72 | 482 | 4,312 | 574 | 50 | 4,325 | 5,577 | 2,209 | 2,149 | 4,358 | 77.6 |
| 69 | 862 | 7,712 | 1,026 | 50 | 2,757 | 5,210 | 566 | 2,333 | 2,899 | 52.9 |
| 71 | 1,596 | 14,278 | 1,900 | 50 | 2,262 | 6,162 | −109 | 2,532 | 2,423 | 36.7 |
| 68 | 1,707 | 15,271 | 2,032 | 50 | 2,134 | 4,960 | −25 | 2,555 | 2,530 | 43.0 |
| 77 | 0 | 0 | 0 | 10 | 5,146 | 5,447 | 5,171 | 0 | 5,171 | 94.5 |
| 81 | 0 | 0 | 0 | 10 | 5,406 | 5,702 | 5,469 | 0 | 5,469 | 94.8 |
| 83 | 75 | 671 | 89 | 10 | 5,129 | 5,478 | 4,626 | 671 | 5,297 | 93.6 |
| 79 | 153 | 1,369 | 182 | 10 | 5,364 | 5,706 | 4,332 | 1,369 | 5,701 | 94.0 |
| 82 | 686 | 6,137 | 817 | 10 | 3,928 | 5,663 | 1,221 | 2,264 | 3,485 | 69.4 |
| 80 | 797 | 7,130 | 889 | 10 | 3,448 | 5,806 | 1,174 | 2,314 | 3,488 | 59.4 |
| 78 | 2,169 | 19,405 | 2,582 | 10 | 1,131 | 5,811 | −1,695 | 2,631 | 936 | 19.5 |
| 75 | 3,619 | 32,377 | 4,308 | 10 | 1,591 | 4,912 | −902 | 2,799 | 1,897 | 32.4 |

* The letters in parentheses refer to the table and equations in the appendix.

## TABLE IX-a

## RESULTS OF NICKEL PLATING ONTO OXIDIZED COPPER

(Spec. area = 1.25 dm²)

| Run No. | Oxide: Oxygen Uptake μg (F) | Oxide: Approx. Thickness Å | Oxide Dissolved During Soak: μg Oxygen (G) | Oxide Dissolved During Soak: Å | Oxide Present at Start of Plating: μg Oxygen (F-G) | Oxide Present at Start of Plating: Å approx. | Oxide Reduced Cathodically During Plating: μg Oxygen (I) | Oxide Reduced Cathodically During Plating: Å approx. | Oxide Present After Plating: μg Oxygen (P) | Oxide Present After Plating: Å | Copper Codeposited μg (Calc. from B = I + N-J) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1** |
| 67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 237** |
| 70 | 39 | 46 | 39 | 46 | 0 | 0 | 0 | 0 | 0 | 0 | −329*[1] |
| 74 | 46 | 55 | 46 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 215* |
| 72 | 482 | 574 | 240 | 286 | 242 | 288 | 264 | 314 | −22 | −26 | 297 |
| 69 | 862 | 1,026 | 261 | 311 | 601 | 715 | 504 | 600 | 97 | 115 | 646 |
| 71 | 1,596 | 1,900 | 283 | 337 | 1,313 | 1,563 | 814 | 969 | 499 | 594 | 975 |
| 68 | 1,707 | 2,032 | 286 | 341 | 1,421 | 1,692 | 534 | 636 | 887 | 1,056 | 930 |
| 77 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25** |
| 81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 63** |
| 83 | 75 | 89 | 75 | 89 | 0 | 0 | 0 | 0 | 0 | 0 | 168* |
| 79 | 153 | 182 | 153 | 182 | 0 | 0 | 0 | 0 | 0 | 0 | 337* |
| 82 | 686 | 817 | 253 | 301 | 433 | 515 | 465 | 554 | −32 | −38 | 22 |
| 80 | 797 | 889 | 259 | 308 | 538 | 640 | 503 | 599 | 35 | 42 | 543 |
| 78 | 2,169 | 2,582 | 294 | 350 | 1,875 | 2,232 | 1,054 | 1,255 | 821 | 977 | 859 |
| 75 | 3,619 | 4,308 | 313 | 373 | 3,306 | 3,936 | 659 | 785 | 2,647 | 3,151 | 965 |

* See Table X.
** Since blank runs indicated no dissolution of clean copper, it would be expected that these values would be zero. These figures may be considered an indication of the precision of the data noting the quantity of nickel plated in each experiment.
[1] This result was obviously erroneous.

TABLE X

WEIGHT OF CODEPOSITED COPPER
CALCULATED vs. EXPERIMENTAL RESULTS

(Spec. area 1.25 dm²)

| Run No. | *Measured Wt. Change During Plating (N) μg | Wt. Nickel Deposited (J) μg | Wt. Change in Excess of Nickel Plated (N-J) μg | Copper Codeposited (Calc.) (B) μg | Discrepancy μg (Measured − Calculated) |
|---|---|---|---|---|---|
| 74 | 6,075 | 5,860 | 215 | 197 | +18 |
| 79 | 5,701 | 5,364 | 337 | 371 | −34 |
| 83 | 5,297 | 5,129 | 168 | 380 | −212 |
| 70** | | | | | |

* These values represent measured weight change during soak and plating cycles corrected for weight of $Cu_2O$ dissolved during soak period (see Table VIII).
** Run No. 70 has been ignored. See footnote, Table IXa.

data which will be reported in a subsequent publication.

## SUMMARY


1. Electrochemical reduction of copper oxide consumes a large share of the current under conditions studied. In the case of thinner films (<650 Å), all of the oxide present at the start of plating may be removed by this mechanism.

2. Under the circumstances investigated, there appears to be little doubt that where oxide films thicker than 650 Å are present at the start of plating, appreciable quantities of oxide remain on the specimen after plating (presumably under the nickel plate), the amount increasing with the original thickness of the oxide film.

3. When oxidized copper cathodes are allowed to soak in the Watts bath prior to plating, even at high *p*H values, significant oxide dissolution occurs, producing a cathode film rich in copper ions.

4. These copper ions codeposit with the first layer of nickel deposited, producing an initial layer of copper-nickel alloy.

5. A five-fold change in current density (from 10–50 amp/ft²) appears to be without significant influence on any of the above electrode processes.

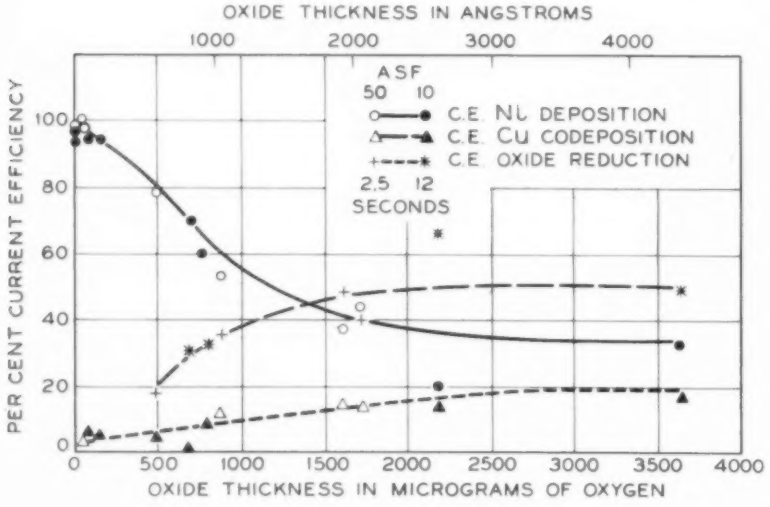




**Fig. 5** Effect of oxide thickness on current efficiency of electrode processes

## APPENDIX

The following symbols have been adopted:

A = wt unoxidized copper, μg
B = wt copper codeposited as copper-nickel alloy, μg
C = wt copper in copper oxide, μg
D = wt copper in copper oxide dissolved prior to plating, μg
E = wt copper in copper oxide dissolved during plating, μg
F = wt oxygen in oxidized specimen, μg = (O − A)
G = wt oxygen in copper oxide dissolved prior to plating, μg
G′ = wt oxygen in copper oxide dissolved during plating, μg


Contribution No. 68 from the Chemical Engineering Department, Engineering Center, Columbia University, New York, N. Y.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H = F–G = wt oxygen in copper oxide remaining on specimen at start of plating, $\mu g$

I = wt oxygen in copper oxide reduced cathodically, $\mu g$

J = wt nickel plated (determined by analysis), $\mu g$

K = theoretical wt nickel deposited at 100 per cent current efficiency (calculated from coulometer), $\mu g$

L = wt of specimen after plating, $\mu g$

M = wt change during entire plating and soak cycle = L–O, $\mu g$

N = wt change during plating cycle only = (L–O) + (D + G), $\mu g$

O = wt oxidized specimen, $\mu g$

P = wt oxygen in copper oxide remaining after plating, $\mu g$

Q = wt copper in copper oxide displaced during plating, $\mu g$

R = wt oxygen in copper oxide displaced during plating, $\mu g$

An overall material balance for the weight changes occurring during plating may be written as follows:

wt change during plating = $wt_{Ni\ deposited} + wt_{Cu\ codeposited} - wt_{oxygen\ lost\ in\ Cu_2O\ reduction\ during\ plating} - wt_{Cu_2O\ dissolved} - wt_{Cu_2O\ oxide\ displaced}$

or

(1) $(L–O) + (D + G) = N = J + B - I - (E + G') - (Q + R)$

This material balance, in conjunction with consideration of the coulombs passed during the plating cycle, enables a calculation to be made of the secondary electrode processes which are taking place under these conditions.

Consider the following material and coulomb balances:

(2) Total coulombs − coulombs used to deposit Ni = coulombs used to codeposit Cu + coulombs used for $Cu_2O$ reduction + coulombs used for $H_2$ evolution

(a) Assume coulombs $H_2$ = O, i.e., that no H evolution occurs, then

(3) $Coulombs_{Total} - Coulombs_{Ni} = Coulombs_{codeposited\ Cu} + Coulombs_{Cu_2O\ reduction}$

(b) but if no appreciable oxide dissolution or displacement occurs *during* plating, then

(4) $wt\ change\ in\ plating = wt_{Ni} + wt_{Cu\ codeposited} - wt_{O\ lost\ from\ Cu_2O\ reduction}$

(5) or $wt\ change\ in\ plating - wt_{Ni} = N–J = wt_{Cu\ codeposited} - wt_{O\ lost\ in\ Cu_2O\ reduction}$ or N–J = B–I.

(6) B = I + (N–J)

but:

$$(7)\quad Coulombs_{Total} - Coulombs_{Nickel} = \frac{B}{329.38\ \mu g/coulomb} + \frac{I}{82.08\ \mu g/coulomb}$$

Substitute (6) in (7)

$$Coulombs_{Total} - Coulombs_{Nickel} = \frac{I + N–J}{329.38} + \frac{I}{82.08} = \frac{I + N–J}{329.38} + \frac{4.012\ I}{329.38}$$

$$(8)\quad Coulombs_{Total} - Coulombs_{Nickel} = \frac{5.012\ I + (N–J)}{329.38}$$

$$329.38\ [Coulombs_{Total} - Coulombs_{Nickel}] = 5.012\ I + (N–J)$$

$$(9)\quad I = \frac{329.38\ Coulombs_{Total} - Coulombs_{Nickel} - (N–J)}{5.012}$$

Also:

$$B = I + N–J$$

and

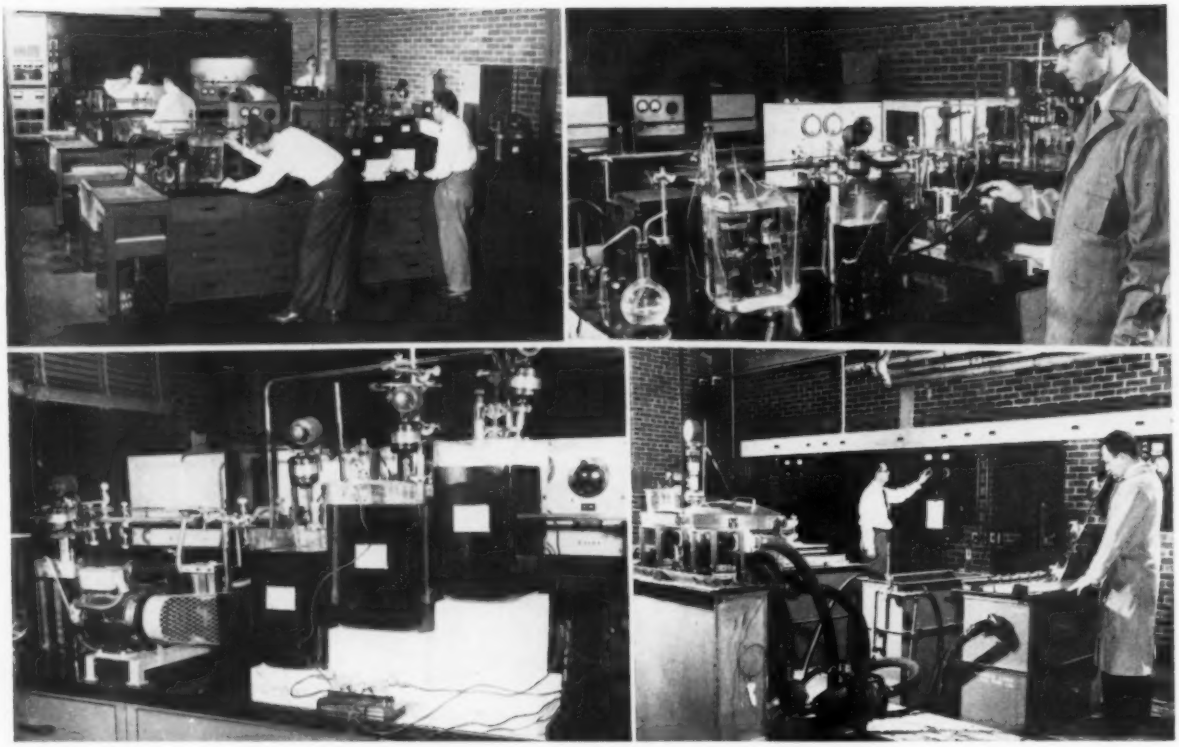
(10) P = wt oxygen remaining on specimen after plating = (F–G) − I

**Dr. Henry B. Linford** received his BS in chemistry from Utah State Agricultural College in 1931, MS from State College of Washington in 1933 and PhD in physical chemistry from State College of Washington in 1936. He was Weston Fellow in Electrochemistry, Columbia University, 1936–37. From 1937 to 1941 Dr. Linford was associated with American Smelting & Refining Co., Central Research Laboratories. He joined the faculty of Columbia University as an instructor in chemical engineering in 1941 and is now Professor of Chemical Engineering at Columbia.

Dr. Linford has been secretary of the Electrochemical Society, Inc. since 1949 and will become vice president in May of this year. He is Director of AES Research Project No. 12 and a Fellow in New York Academy of Sciences.

**David O. Feder** obtained his BS (1945) and MS (1948) from Columbia University, where he is currently completing studies for his PhD in chemicel engineering. He was a DuPont Fellow from 1950–51 and an AES Fellow from 1951–54.

Mr. Feder is a member of the technical staff of Bell Telephone Laboratories. Prior to this he was a part-time research associate, Burns & Roe, New York and research electrochemist, American Electrometals Corp. He is a member of the Electrochemical Society.



(Top left) Bench-scale plating laboratory at International Nickel. (Top right) Bronze valve in the process of being electroless nickel plated. (Lower left) Control apparatus used in the study of nickel plating with insoluble anodes. (Lower right) Manual plating automobile hub caps with bright nickel.

# ELECTROPLATING RESEARCH AT THE INTERNATIONAL NICKEL COMPANY RESEARCH LABORATORIES

RESEARCH has attained an importance little dreamed of short years ago, its accomplishments are gigantic. This is as true in industry as it is in geophysics.

To observe what has been done in nickel research, attention is naturally focused on The International Nickel Co. of Canada, Ltd., the largest producer of nickel and nickel alloys in the world. At the time the original company was organized in 1902 there were very few uses for nickel. Ninety per cent of its sales were accounted for by four outlets, namely, nickel steels (mainly for armor-plate and ordnance), nickel plating, coinage and nickel silver. When the first World War ended and the Disarmament Conference was held, the largest of those markets was lost for the time being. Inco management then showed its foresight by instituting a long-range program

The main laboratory building of Inco's Bayonne research facilities.

for diversification of the application of nickel by means of research and market development. Over the intervening years this program has been so successful as to alter completely the complexion of the company's business. The uses of nickel are now extremely diversified so that it would be difficult to select a major manufacturer who does not require nickel for his products or for his plant equipment.

The Research Laboratory of the American subsidiary, The International Nickel Co., Inc., at Bayonne, N. J. is dedicated to continuation of this never-ending diversification of the applications of nickel. It does not normally concern itself with problems involved in the production of nickel. For these there is a laboratory near the mines, smelters and refineries in Copper Cliff, Ontario. It does not concern itself greatly with the problems involved in manufacturing nickel alloys at the rolling mills, which are served by their own laboratory at Huntington, W. Va. It does concern itself with almost every phase of industry in which there exists an active or potential market for nickel and the other products of the parent company, including the platinum group of metals. There is a laboratory similar to the Bayonne laboratory in Birmingham, England which is operated by a subsidiary, the Mond Nickel Company, Ltd.

The rate of growth of the Research Laboratory has been such that it has outgrown its facilities and required new building construction in every decade since it was started in 1925. Major expansions occurred in 1930 and 1949 and now plans are being made for new construction in 1959. A point of especial interest is the attitude of Inco management toward the future possibilities for nickel in the field of electrodeposition. It is very optimistic. This optimism has been backed by (1) a substantial investment in a large modern electrochemical building equipped with the latest facilities for small scale research and pilot scale development, and (2) a gradual but steady increase in the research staff assigned to this field.

The buildings comprising the research facilities in Bayonne cover a considerable triangular area. The imposing, three-story main laboratory building contains the offices, library, file room, laboratories for research in corrosion, metallurgy of the platinum metals, metallography, creep, stress rupture, metal physics, welding, analytical and spectrographic laboratories, a mechanical test room, machine shop and receiving and stock rooms.

Pilot and small scale equipment for melting, casting, forging, hot- and cold-rolling of experimental metals and alloys are located in the experimental mill and foundry building.

Smaller buildings house the maintenance shops, welding rod extrusion laboratory and storage facilities.

The electrochemical section, in its own building, contains a laboratory for carrying out work on a bench scale and a large electroplating pilot plant. Recently a new laboratory for the vacuum-fusion gas analysis of metals and metallic coatings has been added.

A weathering station provides areas boldly exposed and sheltered for testing the behavior of metals and coatings in the Bayonne atmosphere which is like that of New York City, a typical urban atmosphere. In one area, metals may be exposed to the soil.

## ELECTROPLATING AND METALLIC COATING RESEARCH

The electrochemical section is devoted entirely to research in the field of electroplating and metallic coatings. Progress in any given field of science is dependent upon the aid and participation of specialists in allied fields of science with their special knowledge, instruments and techniques. This is certainly true in electroplating research where many of the problems require the use of skillful metallographic techniques, electron and X-ray microscopy, X-ray diffraction and special analytical methods. The Electrochemical Section of Inco's Bayonne Research Laboratory is in an advantageous position for this kind of cooperative effort because it has all of these facilities at its disposal.

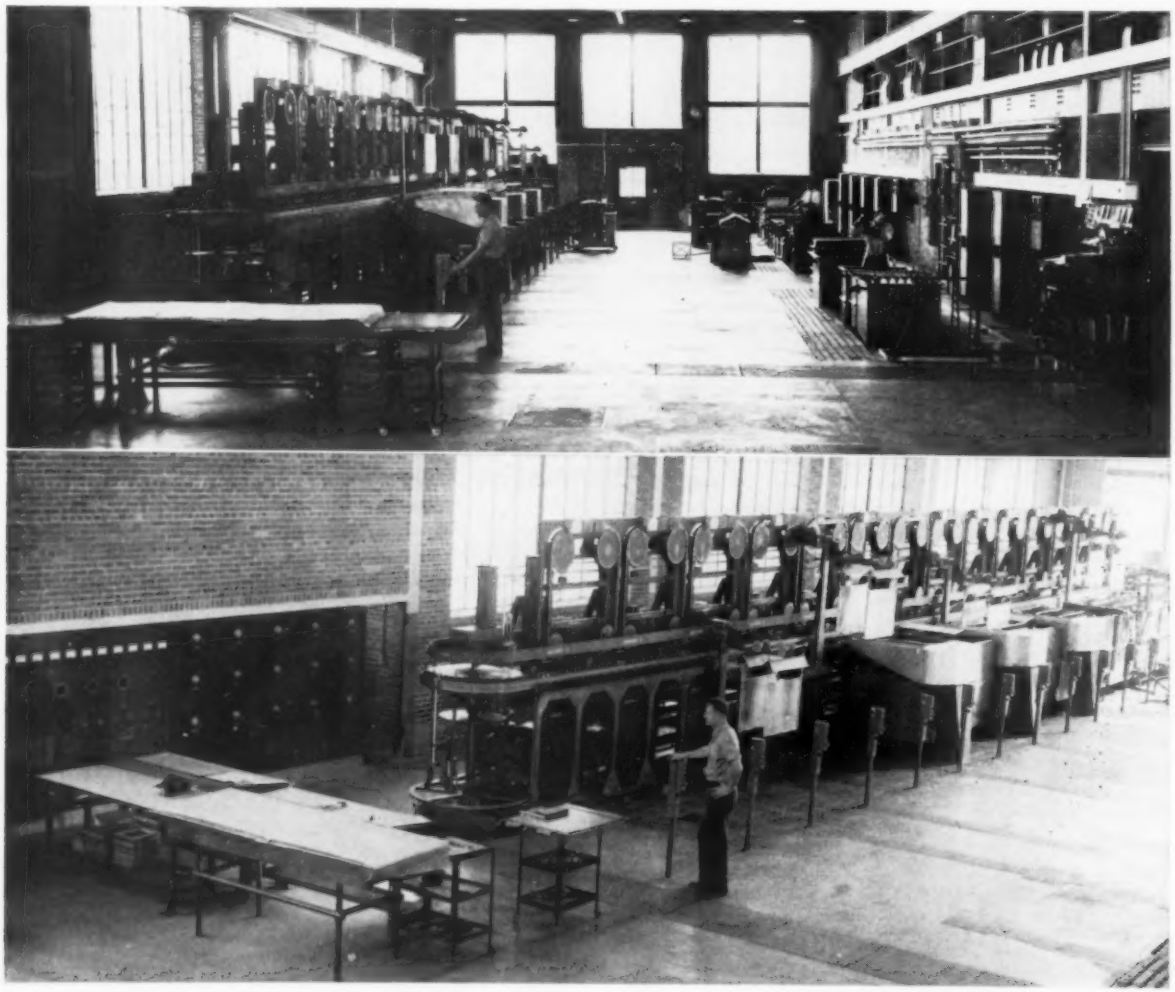
In addition, the electrochemical group in Bayonne has the consultative assistance of the International Nickel's plating

specialists of the Development and Research division in the New York office. These people are continually engaged in activities devoted to improvements in electroplated coatings and processes and their application to meet particular needs. They are in constant contact with the practical problems encountered in the electroplating and finishing industry.

The pilot-scale laboratory is equipped with the world's only fully automatic pilot plating plant and a manual plating line. The pilot plant offers to industry, on a selective basis, an opportunity to test both new coatings and new processes on a scale as close as possible to an actual industrial plating plant. This is accomplished by means of a fully automatic plating line capable of producing coated metal test panels in large numbers, with an extremely high degree of control to assure uniformity. These panels, together with data obtained in their production, provide the plater with an accurate forecast of the practical feasibility of a new-type coating or plating method.

The automatic equipment has provision for 13 different stages of plating and/or cleaning and is capable of handling work up to 3 feet in cross section. The tanks are 400-gallon capacity and include rubber-lined, lead-lined and unlined steel to cover a variety of plating needs. It can be operated entirely from a central panel board where time, current and voltage for each stage of a cycle can be observed and controlled. Power for cleaning and plating operations is supplied by a bank of 6 rectifiers, each rated at 1000 amperes at 12 volts and 2000 amperes at 6 volts. The machine is equipped with a means of fume exhaustion at each station. An outstanding feature is its great flexibility. Designed for simple handling with a lift truck, the tanks can be quickly moved in any desired sequence. The transferring and conveying mechanism permits work to remain stationary from as little as 5 seconds to as much as several hours.

The manual plating line consists of 18 stations and is equipped with rubber- or lead-lined tanks and steel rinse tanks, ranging in size from 100 to 300 gallons and can be placed in any sequence desired. Solutions for electrodepositing the following metals are available, hard nickel, soft nickel, bright nickel, copper, tin and chromium. The equipment includes pumps and filter presses for continuous filtration of solution, a cathode agitator, a variety of immersion heaters and several heat exchangers. Current is supplied by 7 rectifiers ranging



(Top) Main section of the pilot plating laboratory. Continuous line plating equipment is on the left. Manual operation is at the right. (Bottom) Close view of the automatic plating machine. It can be operated entirely from the central control board.

Creep-rupture units with extensometers which record automatically changes in specimen length.

in capacity from 300 amperes at 12 volts to 2000 amperes at 6 volts. Each station in the manual line is equipped with a means of exhausting toxic fumes.

The bench-scale laboratory is one of the finest plating laboratories in the country. The benches and hoods are supplied with all of the necessary services such as air, gas, electricity, water, etc. Current is supplied by several individual portable rectifiers connected to an automatic voltage stabilizer. These range in capacity from 25 amperes at 12 volts to 300 amperes at 6 volts. Automatic timers are available for accurate and close control of the quantity of current used. Periodic reverse plating may be done in conjunction with the above equipment. Various types of modern electrochemical apparatus and equipment such as potentiometers, recorders, *p*H meters, etc. make possible detail studies of solution characteristics, electrode potentials, electrode polarization, current efficiencies, and throwing power. A surface analyzer and stress gages are also at hand to determine surface finish and measure stresses in electrodeposits.

Other facilities in the section include a polishing and buffing room, equipment for salt spray testing and a controlled humidity room for storage of metal.

Recently put into operation is a newly designed apparatus for studying the influence of gases in metals. As a metallurgical research tool, it will provide information on the amount of gases in metals and metallic coatings. The principle of this vacuum-fusion method of analysis is based on the fact that, at sufficiently high temperatures, most oxygen-containing compounds in metals are reduced by carbon with the evolution of carbon monoxide. Also at these temperatures most nitrides decompose with the evolution of nitrogen and occluded hydrogen or hydrides produce hydrogen. The method thus affords a means of analyzing for oxygen, nitrogen and hydrogen on a single sample. The apparatus employed for vacuum-fusion analysis consists essentially of a small furnace for melting the metal in a carbon containing bath, mercury diffusion pumps for extracting the gases, and an analytical system for measuring and analyzing the gas sample.

The gases evolved from the fused samples are rapidly pumped out of the furnace by a high-speed mercury diffusion pump and are then collected and analyzed by a specially designed mass spectrometer coupled directly to the all-glass extraction apparatus. The advantages of this method over others are its rapidity, sensitivity and positive identification of the components of the gas.

Research concerned with the electrodeposition of the platinum metals is primarily carried out by the platinum metals section. The personnel here are primarily engaged in research on platinum, palladium, ruthenium, rhodium and iridium.

During the planning stages of a research program, references to past work in the field are made and thus the availability of an up-to-date library assumes considerable importance. Inco's library is growing continually and now contains over 3500 technical books and bound periodicals. A well diversified pamphlet file is maintained for the convenience of the personnel. The staff is encouraged to make the most complete use of the material available, with a freedom from restrictions not often found in technical libraries.

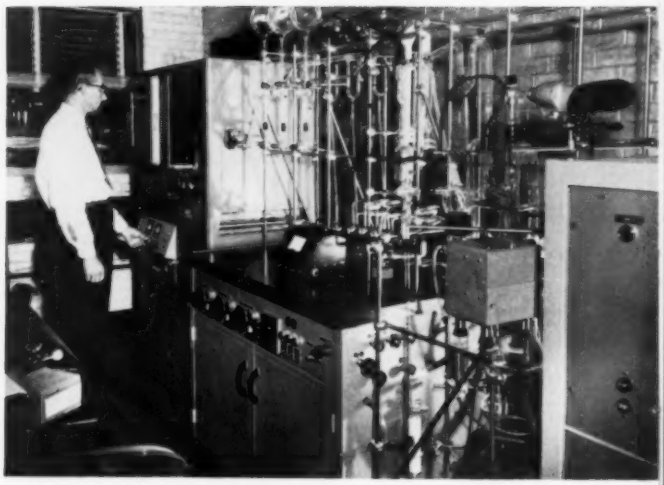
A technical file room is maintained for copies of reports and technical papers prepared by the staff. These reports are abstracted and cross-indexed. There is also a file of patents, domestic and foreign, resulting from or pertaining to the work undertaken here.

Equipment includes the optical microscope for the study of metal deposits and basis metals. Facilities are provided for the preparation of specimens and the latest models of bench microscopes and research metallographs have helped to solve many problems. A Tukon micro-hardness tester is used to measure the hardness of microconstituents and electrodeposits.

Corrosion research is carried out on a wide variety of metals.

Structure of metals as seen on an electron microscope.

Measurement of permeability of metal membrane to hydrogen.



Vacuum-fusion apparatus with mass spectrometer for gas analysis of metals.

alloys and metallic coatings. All types of equipment are available for corrosion testing according to standard specifications such as the total immersion test, the Huey Test and the standard salt spray test.

For long range research projects, it is often necessary to devise special equipment. One such program is concerned with the measurements of the permeability of metal membranes to hydrogen. This equipment has also been found useful in studying the permeability of hydrogen through electrodeposits.

The electron microscope provides a way of studying the structure of metals at magnifications as high as 200,000 diameters with excellent resolution. Because of the low penetrating power of electrons, plastic replicas of polished and etched metal surfaces are made and high-lighted by the oblique deposition of germanium under vacuum.

By the use of X-ray techniques, research is conducted on the atomic arrangement in solids and the interactions between atoms in the solid state. Metallic coatings are examined from the viewpoint of atomic structure with emphasis upon fundamental structures. X-ray diffraction and spectroscopy are employed in a wide variety of problems ranging from phase determination to the analysis of oxidation and corrosion products.

The use of the electron microscope and X-ray equipment in the study of metallic coatings is essential to a better understanding of their structure and to progress toward the development of improved electroplated and chemical coatings.

An electron probe micro-analyzer has been ordered from a French firm for delivery in the near future. This instrument is the first of its kind commercially available in the world. By combining the features of an optical microscope, an electron focusing system and an X-ray spectrograph it makes possible the chemical analysis of a selected area about one micron in diameter. The new instrument will give quantitative information on the chemical composition of microstructural constituents as small as the limit of resolution of the metallographic microscope.

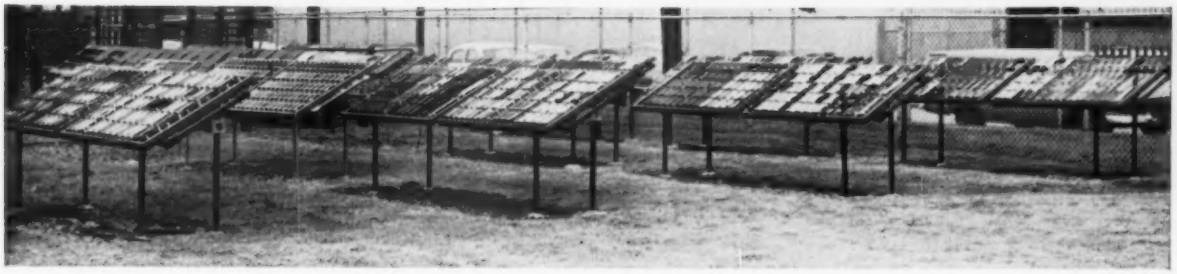
The spectroscopy laboratory is equipped with the most up-to-date instruments. The optical spectrograph, with spark and arc excitation, is capable of analysis of many elements into the fourth decimal place. The X-ray spectrograph allows determination in a matter of seconds of minor components present in as little as one-tenth of a per cent and also the major constituents in an alloy.

The X-ray spectrograph is employed for identification and quantitative analysis of most all the alloys produced by Inco. The method is non-destructive. The sample is analyzed without dissolving or even burning the sample in the least bit. When the specimen is flooded with X-rays, each element in the unknown emits a characteristic radiation which is separated by a crystal. A Geiger counter or a more sensitive counter measures the intensity of each wave length which may be recorded automatically if desired. The wave lengths of X-rays emanating from the lighter elements such as silicon and aluminum are strongly absorbed by air; in working with these elements helium is used to replace the air. The X-ray spectrographic technique is proving to be more accurate and much faster than the older chemical procedures.

One important use of this X-ray technique in electroplating research is the determination of the thickness of very thin nickel deposits on steel.

An important phase of the electroplating research at Inco is concerned with relatively thick nickel coatings and electroforms for industrial and engineering applications. A knowledge of the mechanical properties and weldability of the metal becomes very important in such applications. The mechanical and high temperature testing equipment and the aid of welding specialists are indispensable for progress in this field of research.

Conventional impact tests at sub-zero, room or elevated temperatures; Rockwell, Brinell and Vickers hardness tests; fatigue testing and conventional tensile and torsion tests are all part of Inco research. Equipment is also at hand for the induction of certain special properties such as relative resistance to wear and galling.

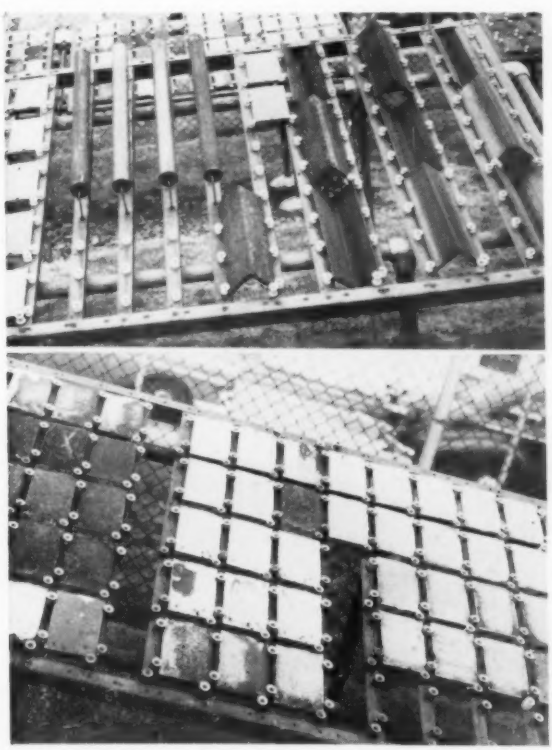


Panels exposed to the atmosphere to test the behavior of metals and coatings.

In the creep testing laboratory tests can be made under constant axial load in tension at constant temperature. In general, applied loads are below the yield strength of the material being tested and are maintained constant throughout the test period. Using a sensitive dial gage creep in increments as small as 0.0005 in. over a 4-in. gage length is measured and recorded throughout the test.

In certain applications the short time high temperature tensile properties are needed. For this Inco has universal testing machines having a load capacity of up to 200,000 lb, equipped with furnaces and temperature controls for making the conventional tests.

A hot hardness tester has been designed and constructed for use at elevated temperatures under an atmosphere to minimize oxidation of the diamond penetrator and the surface of the test specimen.



Close-up views of the test panels at the weathering station in Bayonne.

The welding shop is equipped with a variety of welding machines including both motor-generator and rectifier types of direct-current power sources, an alternating-current power source, tungsten-arc welding torches, two types of inert-gas consumable-electrode welding machines and oxy-acetylene welding equipment. Accessory apparatus includes a four-foot welding platen for restraining large weldments, a welding positioner and a portable high speed recording voltmeter and ammeter for charting the electrical conditions under which the various test welds are made. In addition, there is a large custom-built automatic welding machine which, with suitable attachments, can be used for welding by the coated-electrode, submerged-arc, tungsten-arc and consumable-electrode processes. Since travel speed, arc length, wire feed and welding current are all mechanically controlled, a series of welds can be produced under identical welding conditions.

The experimental mill and foundry often play a role in Inco's electroplating research. An example is an investigation in the rolling of nickel plated steel billets.

The personnel of the engineering section work closely with the research sections in the design of machines and equipment for special purposes and handle the installation of all new facilities that in many cases require considerable engineering design.

The principal activities of the electrochemical section are concerned with the evaluation of new plating processes and coatings, improvement of existing processes for plating nickel and nickel alloys, the development of new plating processes, study of the mechanism of corrosion of electrodeposits, study of the micro-and submicrostructure of electrodeposits, study of the mechanisms of electrodeposition, and the development of new engineering applications for chemically reduced and electrodeposited coatings of nickel and nickel alloys.

The automatic plating machine has been especially suitable for the production of large quantities of plated corrosion test panels frequently required in cooperative technical society test programs, such as those carried on regularly by the American Society For Testing Materials and the American Electroplaters' Society.

Some past developments of the section are a hard nickel bath widely used for reclaiming worn and mismachined parts, an all-chloride nickel bath for producing medium hard deposits and for its high conductivity and excellent anode corrosion, methods for making composite metals including nickel-clad ferrous articles, methods for nickel plating with insoluble anodes, fundamental research on the mechanism of the weathering of electrodeposited nickel, and pioneering research in the field of high speed plating in which it has been demonstrated that sound nickel coatings can be plated at the rate of approximately 4.0 mils per minute.

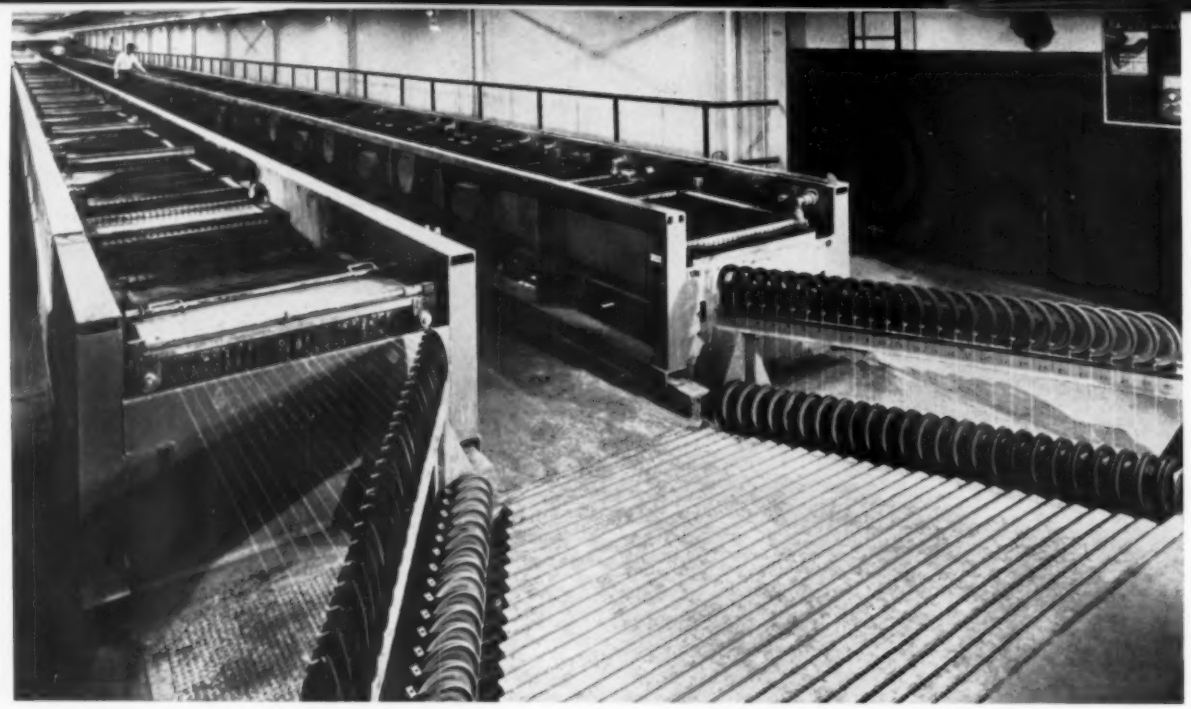


**Fig. 1** One of the two 600-ft long electroforming machines at Western Electric plant. The 25 channels of wire, after having been cleaned and partially plated in the tanks on the left, reverse their direction and travel the full length of the building, receiving added copper coating in the series of plating cells.

# CAST STAINLESS PUMP HANDLES CORROSIVE ELECTROLYTES

by E. A. SCHOEFER*

CONTINUOUS HEAVY COPPER PLATING of steel wire, at the Point Breeze Works of the Western Electric Company, Baltimore, Md., has posed serious problems of handling an extremely corrosive electrolyte, which have been in part solved with the extensive use of cast stainless steel pumps.

Housed in a special building, the 600-foot-long tanks for producing telephone drop wire are shown in Fig. 1. The unique setup involved an electrolyte solution of copper fluoborate containing approximately 5 oz/gal of fluoboric acid and 20 oz/gal of copper. This solution has a *p*H of less than 1, and is used in the temperature range of 120 to 135 F. Western Electric engineers have made extensive use of corrosion resistant materials in tanks, mixing devices, piping and the like, to handle this electrolyte, as well as other extremely corrosive solutions used in the process.

### Cast Stainless Pumps

To handle these corrosive solutions, engineers standardized on heavy duty vertical sump pumps (Fig. 2). All of the metallic pump components below the base plate are made of cast stainless alloy, except for the studs and nuts, which are made of a corresponding grade of wrought stainless steel. Of special importance to the pump's efficiency is the three-blade impeller (Fig. 3), which is especially designed to provide maximum flow with minimum power. Most of the numerous cast stainless parts, such as the impeller and the impeller housing or shell are statically cast; the supporting and discharge pipes, on the other hand, are centrifugally cast.

Since the electrolyte is so corrosive, type CN-7M and type CF-8M (Alloy Casting Institute designations) cast stainless alloys were chosen for all pump parts in contact with the

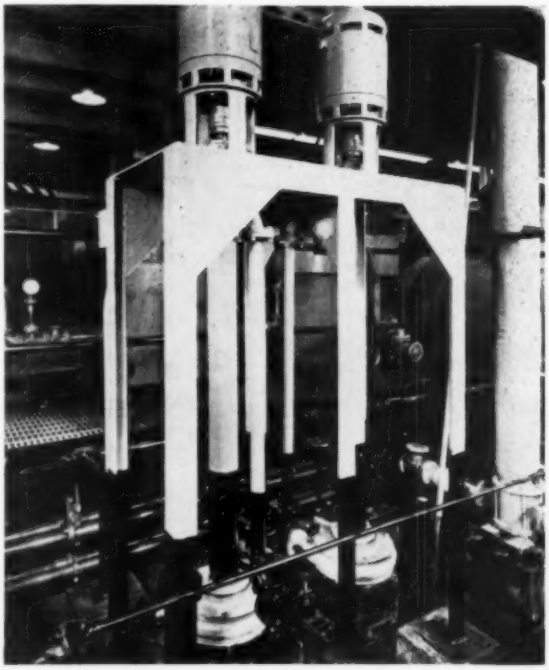


**Fig. 2** Heavy duty vertical sump pumps handle corrosive electrolytes. Critical pump components are made of type CF-8M or CN-7M cast stainless alloys, depending on specific conditions. Made of type CF-8M alloy, the pumps shown are mounted external to the storage tanks, and circulate copper fluoborate during intermittent solution handling.

* Executive Vice President, Alloy Casting Institute, Mineola, New York.

**Fig. 3** Three-blade semi-open impellerh as streamlined design for high efficiency.

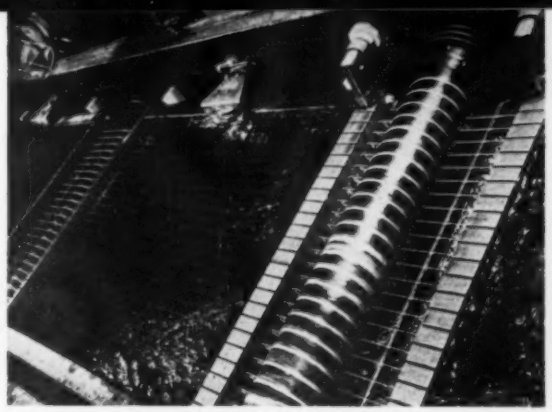


**Fig. 4** Typical cell in the "electroforming" machines. Rolls (foreground) feed electric current to the channels of wire, and propel them through plating solution.

solution. Type CN-7M alloy contains about 29 per cent nickel, 20 per cent chromium, 2 per cent molybdenum and 3 per cent copper, with 0.07 per cent max. carbon. Type CF-8M alloy contains about 20 per cent chromium, 11 per cent nickel, 2.5 per cent molybdenum, with 0.08 per cent max. carbon. To avoid intergranular corrosion, the castings are given a solution heat treatment, which consists of heating the parts between 1950 and 2100 F, and then water quenching.

### Corrodents in Multiple Plating Process

To successively deposit the metallic coatings required to make the completed conductor, the wire receives 32 separate treatments in nine different chemical solutions. Of these, six are so corrosive that cast stainless pumps must be used to handle them.

The wire first enters an alkali cleaner, in which a current density of 100 amp/sq ft is applied to the wire, to remove oil and other impurities. This mixed alkali solution has a specific gravity of 1.1, a temperature of 190 F, and is delivered to the cells by four heavy duty sump pumps, at a throughput capacity of 350 gpm, under a 50-ft head.

In the next step, the wire passes into a sulfuric acid pickle where scale, rust and other mechanical particles are removed; a slight etch is imparted to promote adhesion between the steel wire surface and the subsequent copper deposit. This 15 per cent sulfuric acid solution, with a specific gravity of 1.2 and a temperature of 90 F, is delivered to the cells by another set of four heavy duty sump pumps of the same type, at a rate of 200 gpm, under a 40-ft head. Following the pickle, the wire goes through an air wiper, a water wash, and a steam wiper operation.

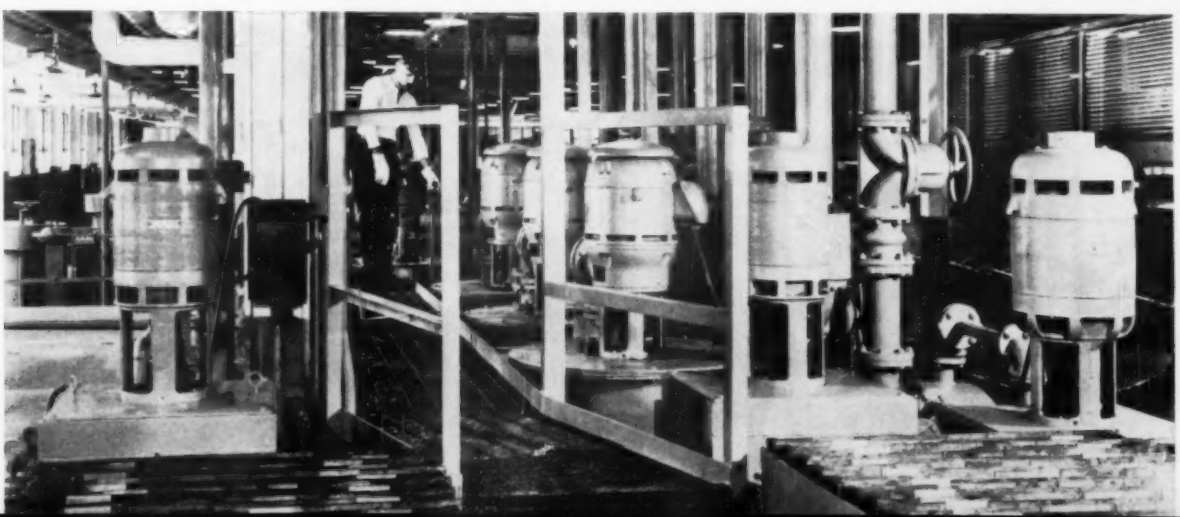
The initial copper coating is a thin "flash" deposited from copper cyanide solutions. These are not corrosive enough to require stainless pumps. Following this "preparation leg," the wire enters the production plating section, where the bulk of the copper is deposited. In this section, there are 58 plating cells (Fig. 4) alternating with 57 copper contact rolls, to prevent overheating of the wire, and to assure close control of the copper deposit. Copper plates in the bottom of the cells distribute current to a bed of copper shot which forms the active anode surface.

Out of a battery of six CN-7M alloy pumps, four are in continuous operation, circulating corrosive copper fluoborate solution from storage tanks to plating cells. This solution has a specific gravity 1.4 and a temperature of 135 F. These pumps are submerged in the storage tanks (Fig. 5) and each pumps 800 gpm at a 60-ft head. Four of six type CF-8M cast stainless steel pumps circulate copper fluoborate solution during continuous filtering and also during intermittent solution handling. These pumps are the vertical sump type but are mounted external to the storage tanks as shown in Fig. 2. They deliver 50 gpm at 125-ft head.

In the "finish leg" of the setup, the wire is passed through a hydrofluosilicic acid bath, which removes oxide formed during an annealing treatment after the production plating. Four CN-7M alloy pumps handle the solution at 90 F, under a 40-ft head at a rate of 40 gpm. A lead plate is then applied from an electrolyte of lead fluosilicate. The active anode surface is provided by lead sheets at the bottom of the cells covered with lead shot. This solution also is handled by four type CN-7M cast stainless pumps, at a temperature of 150 F, under a 40-ft head, and at a rate of 150 gpm.

The final coat applied to the wire is a brass plate, deposited from a brass cyanide solution. This is not corrosive enough to require cast stainless pumps.

**Fig. 5** Pumps transferring copper fluoborate solution to plating cells. All pump parts below the base plate are completely immersed in solution.



TENTATIVE PROGRAM

# 45th ANNUAL CONVENTION
# AMERICAN ELECTROPLATERS' SOCIETY, INC.

**Hotel Sheraton-Gibson, Cincinnati, Ohio**
**May 18-22, 1958**

*(Unless parenthesized, all events are AES)*

## SUNDAY, MAY 18

| | | |
|---|---|---|
| 9:00 a.m. | Executive Board Meeting (All Day) | Parlor E |
| 9:00 a.m.–9:00 p.m. | National Association of Metal Finishers (NAMF) Registration | Ballroom Lobby |
| 9:30 a.m. | Annual Meeting of Members (NAMF) | Parlors 7, 8 & 9 |
| 1:00–8:00 p.m. | Registration | Ballroom Lobby |
| 1:00 p.m. | Trustees' Meeting, Metal Finishing Suppliers' Assn. (MFSA) | Parlor G |
| 1:30 p.m. | Board of Directors Meeting (NAMF) | Parlor I |
| 4:00 p.m. | Credentials Committee | Parlor E |
| 9:00 p.m. | Get-Together Party—*Admission by registration book ticket* | Roof Garden |

## MONDAY, MAY 19

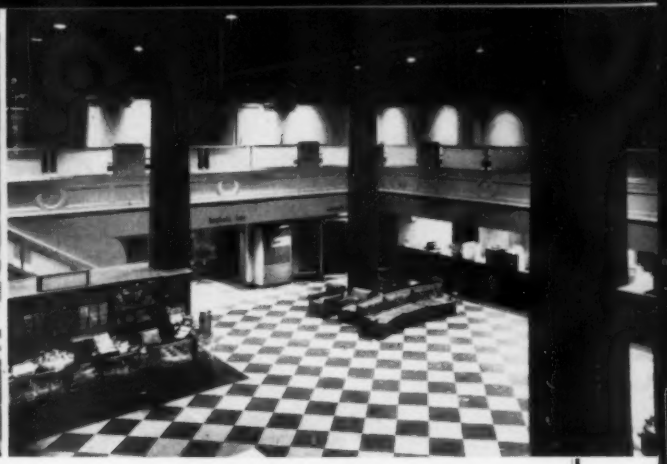
| | | |
|---|---|---|
| 9:00 a.m.–5:00 p.m. | Registration | Ballroom Lobby |
| 9:00 a.m.–5:30 p.m. | Registration (NAMF) | Ballroom Lobby |
| 9:30 a.m. | Secretaries' Meeting (NAMF) | Parlor I |
| 10:00 a.m. | Opening Session<br>Invocation—Leonard A. Chesworth, Boston Branch<br>Address of Welcome—Hon. Donald D. Clancy, Mayor, City of Cincinnati | Roof Garden |
| 11:00 a.m. | Business Meeting, Supreme Society | Sheraton Room |
| 12:00 noon | Branch Secretaries' Luncheon | Parlors 4 & 5 |
| 12:00 noon | Luncheon and Annual Meeting (MFSA) | Ballroom |
| 12:15 p.m. | Speakers' Luncheon | Parlor 6 |
| 1:00 p.m. | Ladies' "Aunt Ella" Luncheon,<br>*Sponsored by Oakite Products, Inc., David X. Clarin, Host* Colony Restaurant (Swifton Village) | |
| 2:00 p.m. | Educational Session A | Roof Garden |
| 2:00 p.m. | Inspection Trip—Cincinnati Milling Machine (Buses leave about 1:00 p.m.) | |
| 2:00 p.m. | First Educational Session (NAMF) | Sheraton Room |
| 2:30 p.m. | Editorial Board Meeting | Parlor I |
| 4:30 p.m. | Order of Past Presidents, Business Meeting | Parlor 7 |
| 6:30 p.m. | Past Presidents' Dinner | Parlor 6 |
| 7:00–9:00 p.m. | Registration | Ballroom Lobby |
| 9:00 p.m. | Open House (MFSA)—*Admission by registration book ticket* | Roof Garden |

Sheraton-Gibson's Bowling Alley

Typical Twin Bedroom

The 31 Restaurant and Bar

Sidewalk Cafe, Sheraton-Gibson Hotel



Lobby of the Convention Hotel

## TUESDAY, MAY 20

| | | |
|---|---|---|
| 8:00 a.m. | Membership Committee Breakfast | Parlor H |
| 8:00 a.m. | Speakers' Breakfast | Parlor 6 |
| 8:30 a.m. | Golf Tournament (MFSA) Kenwood Country Club | Kenwood |
| 9:00 a.m.–12:00 noon | Registration | Ballroom Lobby |
| 9:00 a.m. | Public Relations Committee Meeting | Parlor I |
| 9:00 a.m. | Educational Session B | Ballroom |
| 9:00 a.m. | Midwest Regional Council Meeting | Parlor 4 |
| 9:00 a.m.–12:00 noon | Registration (NAMF) | Ballroom Lobby |
| 9:30 a.m. | Second Educational Session (NAMF) | Parlors 7, 8 & 9 |
| 12:00 noon | Michigan State Alumni Luncheon | Parlor H |
| 1:00 p.m. | Annual Outing—*Admission by registration book ticket* | Coney Island |
| 6:30–8:00 p.m. | Registration (NAMF) | Roof Garden Mezzanine |
| 7:00 p.m. | Reception & Cocktail Party (NAMF) | Roof Garden |
| 8:00 p.m. | Annual Banquet (NAMF) | Roof Garden |

## WEDNESDAY, MAY 21

| | | |
|---|---|---|
| 8:00 a.m. | Research Committee Breakfast | Parlor I |
| 8:00 a.m. | Speakers' Breakfast | Parlor 6 |
| 9:00 a.m.–12:00 noon | Registration | Ballroom Lobby |
| 9:00 a.m. | Educational Session C | Ballroom |
| 9:00 a.m. | Educational Session D | Sheraton Room |
| 9:00 a.m. | Research Committee Meeting | Parlor I |
| 9:00 a.m. | Educational Committee Meeting | Parlor F |
| 12:00 noon | Branch Librarians' Luncheon | Parlor H |
| 12:00 noon | Ladies' Luncheon—*Sponsored by Products Finishing*<br>Mrs. Robert D. Miller, Mrs. William Young, Hostesses | Roof Garden |
| 12:00 noon | Speakers' Luncheon | Parlor 6 |
| 2:00 p.m. | Research Committee Meeting | Parlor I |
| 2:00 p.m. | Educational Session E | Ballroom |
| 2:00 p.m. | Educational Session F | Sheraton Room |
| 2:00 p.m. | Inspection Trip—Procter and Gamble, Ivorydale Plant | |
| 9:30 p.m. | Floor Show and Dance—*Admission by registration book ticket* | Roof Garden |

## THURSDAY, MAY 22

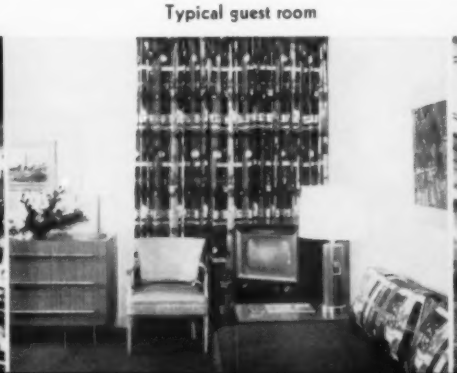
| | | |
|---|---|---|
| 8:00 a.m. | Speakers' Breakfast | Parlor 6 |
| 9:00 a.m.–12:00 noon | Registration | Ballroom Lobby |
| 9:00 a.m. | Business Meeting, Supreme Society | Sheraton Room |
| 9:00 a.m. | Educational Session G (Panel: "Practical Plating Problems") | Ballroom |
| 12:00 noon | Ladies' Luncheon—*Sponsored by Udylite Corp., Dr. R. B. Saltonstall, Host* | Netherland-Hilton |
| 2:00 p.m. | Business Meeting, Supreme Society | Sheraton Room |
| 2:00 p.m. | Inspection Trip—Electric Auto-Lite, Sharonville (Buses leave about 1:00 p.m.) | |
| 2:00 p.m. | Ladies' Plato Party—*Mrs. Joan Wiarda, Hostess* | Netherland-Hilton |
| 7:00 p.m. | Banquet and Dance—*Admission by registration book ticket* | Hall of Mirrors |

## FRIDAY, MAY 23

| | | |
|---|---|---|
| 8:00 a.m. | President's Breakfast for National Officers and Wives | (To be announced) |
| 10:00 a.m. | Executive Board Meeting (All Day) | Parlor E |

Florentine Dining Room

Typical guest room



Grand Ballroom

# EDUCATIONAL PROGRAM
# 45TH ANNUAL CONVENTION
# AMERICAN ELECTROPLATERS' SOCIETY

We'll See You in Cincinnati
45th Annual Convention-May 19-22, 1958
American Electroplaters Society
Will You Effer in Cincinnati?

Invitation to Cincinnati

Fountain Square, Cincinnati

MONDAY—MAY 19—2:00 p.m.

## SURFACE PREPARATION (SESSION A)

**Chairman**—John Holland, Arvin Industries
***Educational Committee Representatives:***
Malcolm T. Fogg, Globe Chemical Company
Elmer W. Rehme, Metal & Thermit Corporation

1. **THE ROLE OF THE BASIS METAL IN THE PRODUCTION OF STRESSED ELECTRODEPOSITS**
   by Dr. Joseph B. Kushner, Kushner Electroplating School
   The role of basis metal surface condition and cathode deposition film on stresses produced is discussed. Grain size, deposit thickness, magnitude of stresses developed and other factors are covered in the light of recent literature and experimentation. A theory is proposed as an explanation for this behavior.
2. **EFFECT OF SHOT-PEENING PRIOR TO CHROMIUM PLATING ON THE FATIGUE STRENGTH OF HIGH STRENGTH STEEL**
   by Bennie Cohen, Wright-Patterson Air Force Base
   This effect has been studied in an effort to minimize the drastic drop in fatigue strength, approximately 50 per cent, which occurs as a result of chromium plating. Results using various high strength steels will be compared including baked and unbaked conditions.
3. **LOOSE ABRASIVE FINISHING**
   by Fred T. Hall, General Motors Corporation
   (Abstract will appear in May issue.)
4. **AES PROJECT NO. 14—THE INFLUENCE OF PHYSICAL METALLURGY AND MECHANICAL PROCESSING OF THE BASIS METAL ON ELECTROPLATING**
   by Dr. Maurice H. Jones and J. Zajdowski, Ontario Research Foundation
   A comparison of the influence of the surface condition of an aluminum killed steel, resulting from various commercial and laboratory polishing techniques, on the durability of a Watts nickel deposit. Several types of mechanical finishing of the basis metal studied include commercial belt polishing with alumina abrasives and laboratory polishing with silica carbide and diamond abrasives.

TUESDAY—MAY 20—9:00 a.m.

## WASTE TREATMENT AND DISPOSAL (SESSION B)

**Chairman**—William J. Neill, Columbus Metal Products, Inc.
***Educational Committee Representative:***
Dr. R. O. McDuffie, University of Cincinnati

1. **METAL WASTES—CONTRIBUTION AND EFFECT—CINCINNATI METROPOLITAN SEWAGE DISPOSAL SERVICE AREA**
   by Fenton H. Dobb, City of Cincinnati (Sewage Disposal Section)
   The paper deals with a municipality embarking on a sewage disposal program, including an ordinance for control of industrial wastes, especially metal contaminants. Factors such as: inspection, cooperation, and acquisition of information and analyses of industrial wastes from companies in this service area before and after the ordinance was enacted into law is discussed.
2. **ION EXCHANGE AND THE PICKLING OF MAGNESIUM SHEET**
   by Robert E. Anderson, The Dow Chemical Company
   The role of ion exchange in the metal industry is discussed including purification of exhausted or contaminated solutions and recovery and concentration of valuable materials from dilute solutions. An automatic ion exchange process for acetic acid—nitrate pickling of magnesium sheets, showing reduction of costs and labor and improvement of quality control is described.
3. **THE USE OF BIOASSAYS IN THE SAFE DISPOSAL OF ELECTROPLATING WASTES**
   by Dr. Charles M. Tarzwell, Robert A. Taft Sanitary Engineering Center
   A method of predicting the influence of individual components on the toxicity of complex waste water is described. How bioassays can be used to determine what process contributes most to the toxicity of waste water, how it varies and the type and extent of treatment necessary to render it safe for aquatic life is discussed.
4. **INDUSTRIAL WASTE TREATMENT AND WATER RECLAMATION—A CASE STUDY**
   by Wayne L. Gasper, The Maytag Company
   The planning which went into the building of a complete waste treatment facility is discussed, together with the results of three years' experience in industrial waste treatment and the reclamation and reuse of water after treatment. Costs of waste treatment and some of the methods used to reduce costs will be described.

WEDNESDAY—MAY 21—9:00 a.m.

## SYMPOSIUM ON ELECTROPLATING PRACTICES (SESSION C)

**Chairman**—Dr. Dodd S. Carr, Bart Laboratories & Design, Inc.

***Educational Committee Representatives:***
Ezra A. Blount, Products Finishing
William D. Gordon, MacDermid, Inc.

### 1. PRINCIPLES OF ELECTROCHEMISTRY

by Fred G. Brune, Chrysler Corporation

Using Faraday's Laws as the basis for electroplating, principles of chemistry and electricity are explained. Ionic action in electroplating solutions is covered to show the changes which occur where electrical energy is used to produce a metallic plate. Other electrochemical properties of electroplating solutions are discussed.

### 2. FACTORS WHICH INFLUENCE THE STRUCTURE OF ELECTRODEPOSITS

by Dr. Abraham M. Max, Radio Corporation of America

The theory of metallic crystals and the role of imperfections in determining the physical properties of the common metals is surveyed. Factors affecting the character of electrodeposits are discussed including metal ion transition to the crystal lattice of the cathode, co-deposition, crystal formation, and properties of electrolytes.

### 3. CLEANING, PICKLING AND PREPARATORY SURFACE TREATMENT

by William P. Innes, MacDermid, Inc.

Modern practices in cleaning, degreasing, pickling, and activation of various metals prior to electroplating are discussed. Chemical and physical aspects of cleaning and degreasing and actions of pickling and activation solutions on metal surfaces are covered. Fundamental principles upon which these preplate treatments are based are covered and modern cycles illustrating these operations are outlined.

### 4. DISCUSSION OF A TYPICAL PLATING SOLUTION—CYANIDE ZINC

by Edward F. Foley, Enthone Inc.

The cyanide-zinc plating solution is covered thoroughly beginning with a discussion of bath composition (including the various bright plating solutions), purification of the solution prior to use, and operating conditions. Equipment required for zinc plating and engineering considerations connected with this solution are discussed.

## SPECIALIZED FINISHES FOR AIRCRAFT COMPONENTS (SESSION D)

**Chairman**—Julius Teres, Wright-Patterson Air Force Base

***Educational Committee Representative:***
William B. Stephenson Jr., General Electric Company

### 1. ALLOY PLATING SYSTEMS FOR AIRCRAFT ENGINES

by Bruce E. Scott, Curtiss-Wright Corporation

Performance of electro-deposited lead-indium, lead-tin, and silver-lead under high stress and cavitation erosion conditions is evaluated. Use of electroless nickel on aluminum and the increased salt spray resistance of cadmium-tin is discussed. High ambient temperature corrosion protection of nickel-cadmium and characteristics of new alloy systems of copper-tin, silver-tin, and tin-copper are explained.

### 2. ELECTRODEPOSITED METALLIC AND FLAME SPRAYED CERAMIC COATINGS FOR ELEVATED TEMPERATURES

by Dr. Stanley Zirinsky, General Electric Company, and Dr. Dodd S. Carr, Bart Laboratories & Design, Inc.

Application of heavy nickel and chromium (0.005 to 0.040 in.) to nickel and to copper and over plates of rhodium, platinum, and palladium and flame sprayed alumina are discussed. Reactions of various coatings to a 5000° K plasma jet from a water stabilized arc are evaluated.

### 3. HARD ANODIZING OF AIRCRAFT FUEL METERING COMPONENTS

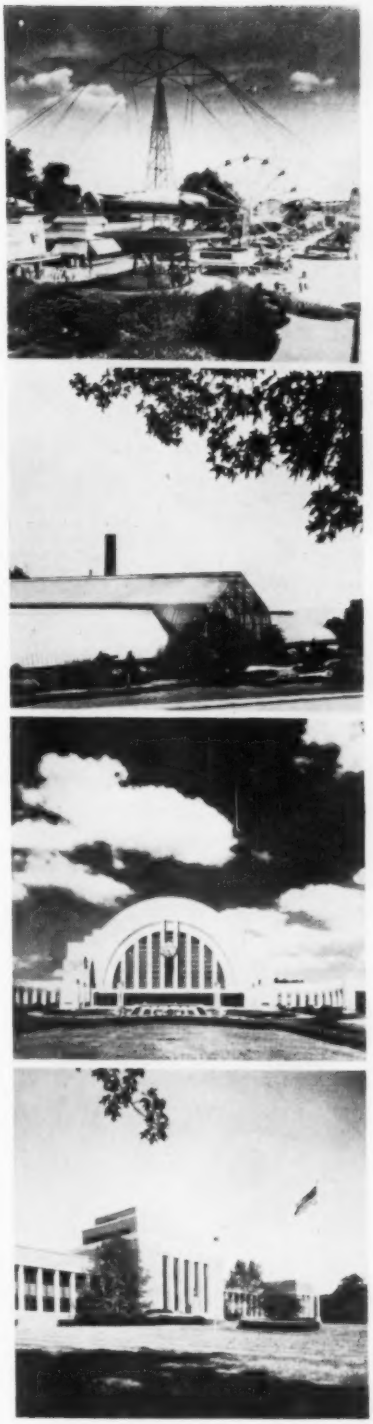
by Dr. Harold J. Wiesner and Henry A. Meers, Bendix Aviation Corporation

The conditions for applying thin or heavy hard coating to various aluminum alloys are given. Methods of controlling thickness on various sections of complicated shapes are discussed. A statistical comparison of various thickness measurement methods is included.

### 4. PITTING IN THICK CHROMIUM DEPOSITS

by Donald R. Millage and Wilbur E. Hague, The Udylite Corporation

The type of defect that is described as a "catalyst pit" and pitting due to basis metal defects are discussed. Results obtained by drilling a micro-hole in the basis metal and plated with and without a surface-active agent is presented. The effect of surface-active agents upon the porosity of thin plates is included.

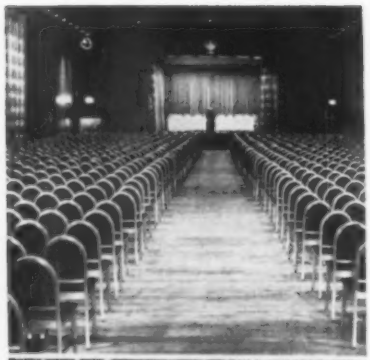


(Top) Cincinnati's Coney Island

(Next Top) Top of Krohn Conservatory of Flowers

(Next Bottom) Union Terminal, Cincinnati

(Bottom) Cincinnati Milling and Grinding Machines plant



(Top) Roof Garden of Sheraton-Gibson

(Next Top) Typical Meeting Room

(Next Bottom) The Keyhole Bar

(Bottom) Minute Chef Restaurant at the Sheraton-Gibson

WEDNESDAY—MAY 21—2:00 p.m.

## SYMPOSIUM ON ELECTROPLATING PRACTICES (SESSION E)

**Chairman**—Gerald A. Lux, Oakite Products, Inc.

***Educational Committee Representatives:***
Ezra A. Blount, Products Finishing
William D. Gordon, MacDermid, Inc.

### 1. PLATING ROOM POWER

by J. M. Andrus, Croname Inc.

Power for electroplating is most commonly supplied by rectifiers or motor generator sets. The various types of rectifiers and characteristics and advantages are discussed. Likewise, the operation and features of motor generators are covered. Electrical principles involved in the installation and use of these power units are covered.

### 2. DESIGN AND ENGINEERING PROBLEMS IN PLATING ROOM LAYOUT AND INSTALLATION

by Hugh V. McGuire, McGuire Associates

Factors involved in planning an electroplating installation are discussed including production rate, type of equipment, type of plating, plating cycles, arrangement of equipment, exhaust systems, location of power units, type of heat or cooling equipment, water pre-treatment and/or disposal. Equipment installation details to eliminate operating and maintenance problems will be suggested.

### 3. PLATING RACK DESIGN AND INSULATION

by Frank J. Klein, Rack Processing Company

Various kinds and types of plating racks are discussed including materials used, size, and construction for various types of plating and cycles used. The five principal types of rack coatings used today, methods of application of insulation materials and the relationship between the coating and the type of plating being done is explained.

## DEVELOPMENTS IN FINISHES AND CONTROLS (SESSION F)

**Chairman**—William H. Safranek, Battelle Memorial Institute

***Educational Committee Representatives:***
Lester A. Helmich, Bendix Aviation Corporation
C. Evans Foertmeyer, General Electric Company

### 1. WHEN AND HOW TO SELECT AN ORGANIC COATING

by Harris G. Beck, The Glidden Company

Properties of the various organic finishes and the relation these have to surface pretreatment is discussed. Application of and curing procedures for organic finishes with their features and economics is presented along with suitable testing procedures to enable the engineer to specify and the customer to obtain the finish desired.

### 2. VINYL PLASTISOLS AND ORGANISOLS AS PRODUCT FINISHES

by F. L. Scott and W. C. Hosford, Metal & Thermit Corporation

Polyvinyl chloride plastisols and organisols are finding greatly expanded use in the functional and decorative fields. Wide ranges in the hardness and smoothness of finish are obtainable. These materials exhibit excellent chemical resistance and electrical insulation properties. Application methods include dipping, roller coating, spraying, and forming by molding.

### 3. INSTRUMENTATION

by Harold A. Kahler, General Motor Corporation

Control instrumentation, in recent years, has given assistance to the electroplater in meeting the exacting demands of specification deposits and lower operating costs. The application, use and merits of instrumentation for large and small installations are reviewed. The advantages of some special electrical and solution control devices are discussed in detail.

### 4. PATTERN PLATING WITH ELECTRODEPOSITS

by Samuel S. Frey, Oakite Products, Inc.

How definite patterns can be produced upon electrodeposited nickel and thin bright plates deposited over it without loss to the pattern intensity will be shown. The details of time, agitation, temperature, current density and chemical composition of the bath will be discussed. Process details for making these patterns and problems to be solved for commercial applications are covered.

THURSDAY—MAY 22—9:00 a.m.

## PANEL DISCUSSION—"PRACTICAL PLATING PROBLEMS" (SESSION G)

**Chairman**—Dr. Abner Brenner, National Bureau of Standards

***Educational Committee Representative:***
Robert L. Winston, Electric Auto-Lite Company

***PANEL MEMBERS:***

Dr. A. Kenneth Graham, Graham, Savage & Associates, Inc.:
**PREPARATION OF BASE METAL AND DECORATIVE PLATING**

Dr. Harold J. Read, Pennsylvania State University:
**CORROSION**

Lloyd O. Gilbert, Rock Island Arsenal:
**CONVERSION COATINGS AND MILITARY REQUIREMENTS**

F. Keller, Aluminum Company of America:
**ANODIZING AND PLATING ON ALUMINUM**

Harold F. Smith, The Smith Electrochemical Company:
**SPECIALTY WORK, JOB SHOP OPERATION**

Fremont L. Scott, Metal & Thermit Corporation:
**ORGANIC COATING**

# TO ALL AES MEMBERS

Back in 1922, some three and a half decades ago, the Cincinnati Branch, then in its ninth year of life, had the privilege of hosting the 10th Annual Convention of the American Electroplaters' Society (AES). During May 18–22, 1958, over a third of a century later, it will again play host to a National AES Convention.

Recognizing that such a privilege entails commensurate responsibility, the Cincinnati Branch, for months, has concentrated upon making the 45th Annual Convention outstanding in every respect. Consequently, it is its hope that when AES multitudes converge upon Cincinnati for the AES Convention this May that they will find the Branch ready with one of the finest Convention sites and programs in our Society's long history.

To each and every member of the AES and his family, this Branch extends a most cordial welcome plus the hope that every moment spent at the 45th Annual Convention will be a happy and valuable one.

*W. Wilson Loveless*
PRESIDENT
CINCINNATI BRANCH

W. Wilson Loveless

## FOR $20: ALL THIS AND BRAIN FOOD TOO

Cost of registration at the 45th Annual Convention in Cincinnati, May 18–22, 1958 will be $20 per male or female adult as in Montreal last June. Men's and ladies' registration books will contain these tickets respectively:

**MEN'S BOOK**
1. Get-Together Party
2. MFSA Open House
3. Coney Island Outing
4. Floor Show and Dance
5. Banquet and Dance

**LADIES' BOOK**
1-5. Same as Male
6 Luncheon, Colony Restaurant
7. Luncheon, Gibson Roof Garden
8. Luncheon, Netherland-Plaza

Children's tickets may only be purchased by a person who has already registered at the Convention. These are available for children under 16 at the following prices: Outing, $2.50; Floor Show and Dance, $2.50; Banquet and Dance, $7.50.

Vas you efer in Zinzinnati? Better come to this AES Convention in Zinzinnati this Zpringtime! Zum fun—AND BRAIN FOOD TOO!

## AMONG CINCINNATI'S CHILDREN'S ATTRACTIONS

Among the attractions in Cincinnati for Delegate's youngsters is that city's famed zoo. From gnus to guanacos—rhinoceroses to hippopotami—organgutans to marmosets—they can view what is billed (quote), "one of the world's greatest animal collections."

## PROCTER & GAMBLE PLANT INSPECTION TOUR

Ray Barry, Plant Visitation chairman, has come up with a fine substitute plant visitation for the tour cancelled by Armco Steel Corp.—the Procter & Gamble Ivorydale plant. This outstanding concern has already supplied our Secretary of Defense, Neil McElroy, and now offers its hospitality to AES members and wives during the 45th Annual Convention.

The visit will be on Wednesday afternoon, and will include a look at the following operations: kettle room, milling, packing, control laboratory and edible fats.

This break in plating activities will be a welcome change.

**PORTION OF AES FAMILY PRESENT AT AES'S LAST ZINZINNATI CONVENTION (1922)**
Over a third-of-a century ago, a youthful AES held its Tenth Annual Convention in Cincinnati, the handsome city on the banks of the Beautiful Ohio. The Society in that day (1922) numbered 23 Branches. Twelfth born Branch, then nine years old, Cincinnati hosted a noteworthy convention. Above, a view of part of the AES family that was there. A target of the Society in that day was to get its "Thousandth Member." This May, over three decades later, AES, now numbering 58 Branches and over 7600 members, will return to Cincinnati for its 45th Annual convention. It will still be seeking technical and scientific knowledge plus fellowship and fun, Zinzinnati style.

# AES NEWS

## BRANCHES TO BENEFIT FROM 1958 SPEAKERS LIST

Streamlined for maximum help to Branch Librarians in scheduling noteworthy technical and scientific talks before their Branch meetings, the AES's 1958 Speakers List has been completed and has been issued to all 58 chartered Branches of the Society.

Product of I. William Marcovitch, Philadelphia Branch Secretary, assigned by National Headquarters to serve as Editor of this ambitious edition, the 1958 Speakers List is a two-part compilation of the results of a mail survey made by Headquarters covering over 400 individuals and companies coast-to-coast asked as to availability for speaking engagements on interesting aspects of electroplating, metal finishing and allied arts.

Part I, an innovation, presents titles by subject thereby allowing well balanced Branch programs to be chosen with a minimum of search through lists. Part II identifies available speakers, geographical areas where the speaker will travel and provides expense information.

Expert both as a user and as a compiler of such lists at Branch level, Mr. Marcovitch is Plant Chemist of the U.S. Gauge Division of American Machine & Metals, Inc. of Sellersville, Pa.

The Speakers List is available only to AES Branches. Next year's edition will be prepared under the aegis of the Society's new Educational Committee.

## DELEGATES RECEIVE INTERIM MEETING MINUTES

Recently completed copies of the mimeographed book "Proceedings, Fifth Interim Meeting" have been issued to all Delegates, with extra copies sent to all Branches for study by Branch Officers and Alternate Delegates in advance of the coming Annual Meeting of the Supreme Society.

The book contains the Minutes of the Interim Meeting of the Supreme Society held at the Marott Hotel, Indianapolis, January 11, 1958.

## WINTERMAN IS GOLF OUTING "HOST"

MFSA's "Sponsoring Host" for its golf outing at the Kenwood Country Club, Tuesday, May 20, is Roger E. Winterman of the AES's Cincinnati Branch and the Convention's Program Chairman. Kenwood has two 18-hole courses, and has been host of many major golf tournaments, including the Western Open in 1955.

L. A. Chesworth

## CHESWORTH TO RENDER CONVENTION INVOCATION

Leonard A. Chesworth of Stoughton, Massachusetts, will give the Invocation at the Opening Session of the AES's 45th Annual Convention in Cincinnati on Monday morning, May 19, 1958, succeeding Past President Frank C. Mesle, now retired, who rendered the Convention's opening prayer for so many years.

A "plater minister" like his predecessor, Mr. Chesworth is a long-time member of the Boston Branch and one of its Alternate Delegates on the AES's highest governing council. He is associated with the United Car Fastener Corporation of Cambridge, Massachusetts.

## AES CONVENTION KIT COMPLETED

So as to convenience Annual Convention chairmen and their committees, National Headquarters has just prepared a Convention Kit each of which compactly includes currently these helpful data, 1) A Convention Manual, 2) Final Montreal Convention report, 3) "Check list of National Headquarters and Convention Committee coordination."

Intended exclusively for AES convention chairmen, co-chairmen and subchairmen, the Kit is already in use in Cincinnati and will soon be issued to Detroit, Los Angeles and Boston Convention Committees.

## 1959: AES's GOLDEN JUBILEE YEAR

FIFTIETH ANNIVERSARY observance plans will be considered at the meeting of the Public Relations Committee to be held on Tuesday morning, May 20, 1958 during the Society's 45th Annual Convention in Cincinnati.

Founded in 1909, the AES will celebrate its Golden Anniversary in 1959. It will be climaxed by the Golden Jubilee Convention and International Exposition, including the Fifth International Conference on Electrodeposition and Metal Finishing, that the AES will conduct in Detroit, June 14–18, 1959 with Detroit as Host Branch.

## EDITORIAL BOARD FINALIZES CONVENTION EDUCATIONAL PROGRAM

**Convened at the Sheraton-Gibson Hotel, Cincinnati, February 26, for the purpose of finalizing the Educational Sessions of the AES's 45th Annual Convention, the Editorial Board approved a program comprising 24 technical and scientific papers grouped into six sessions. In addition, the Board approved a panel program, an innovation in Convention educational fare, that will feature discussion of practical plating problem questions by a group of six experts, each an authority in his field.**

**Aside from approving the foregoing program fully spread on Pages 370-2 of this issue of PLATING, a program well prepared by the Host Branch Educational Committee headed by Robert D. Miller, the Editorial Board also commenced preliminary work with Host Branch Educational Chairman Walter L. Pinner on the Fifth International Conference on Electrodeposition and Metal Finishing that will be conducted in Detroit in June 1959 as an element of the AES's Fiftieth Anniversary observance. Co-Chairmen are Dr. R. B. Saltonstall and Myron B. Diggin.**

**Present at the Board meeting beside Chairman John P. Nichols who presided were Donald C. Austin, Dr. Abner Brenner, John B. Capuano, G. Ross Davidson, S. Lewis Doughty, Rodney Leeds, Dr. Abraham M. Max, Robert D. Miller, Fremont L. Scott and William M. Tucker.**

M. M. Beckwith

T. A. Trumbour

E. W. Couch

## MFSA PURSE FOR NEW AES BRANCHES

As a token of goodwill and cooperation between the Metal Finishing Suppliers' Association (MFSA) and the American Electroplaters' Society (AES), any new AES Branch permanently chartered by the AES Executive Board after June 1, 1958 will receive from the MFSA a $100 purse as a donation, plus a suitable certificate of congratulations and encouragement.

This recent MFSA enactment by the Board of Trustees of that Association resulted from the proposal recently made to it to this effect by Dr. M. M. Beckwith, Harshaw Chemical Company, MFSA's president, and reported to AES by its official MFSA liaison representative, namely Earle W. Couch, president, Lea Manufacturing Company and MFSA's current first vice president.

The resolution adopted by the MFSA reads in full:

> "It was voted unanimously to adopt a plan advanced by the President in the interest of goodwill and cooperation of donating to each new Branch of the AES granted its Permanent Charter after June 1, 1958, a purse of $100 to be known as the MFSA Thomas A. Trumbour Award, together with an appropriate certificate to be designed by the Publicity Committee of the MFSA."

The foregoing MFSA Award to AES's newly chartered Branches after June 1, 1958 will, of course, be additional to the framed official permanent Charter given to each such AES Branch by the Society itself upon, 1) meeting the AES's constitutional requirements, 2) being voted into the AES's family of chartered Branches by the Executive Board and 3) being officially installed as such by the Executive Board's official installation team headed by the National President.

## MILWAUKEE SCHEDULES TOP ANNUAL MEETING

The Annual Banquet and Educational Session of the AES Milwaukee Branch will be held Saturday, April 26, at the Hotel Schroeder, Milwaukee, Wisconsin.

The Educational Session starts at 9:30 a.m. Its theme will be "The Challenge of Outer Space."

John P. Nichols, National Executive Secretary of the AES and Managing Editor of PLATING, will be the guest luncheon speaker.

For the educational sessions the group will be addressed by Harold Mueller, Dr. Donald Swalheim and Milton A. Glaser. Harold Mueller, chief process engineer, AC Spark Plug Division of General Motors Corp. Milwaukee Plant, will talk on "The Precision Cleaning and Deburring of Missile Guidance Components." Dr. Donald Swalheim, Research Laboratory, Electrical Chemical Division of E. I. du Pont de Nemours & Co., Inc. will cover "Recent Developments in Copper Plating" and "Modern Organic Finishes for High Temperature and Abrasive Protection" will be the subject discussed by Milton A. Glaser, vice president and technical director of Midland Industrial Finishes Company.

## EMPIRE STATE REGIONAL MEETS AT ROCHESTER

The Fourth Annual Empire State Regional Conference of the American Electroplaters Society will be held in Rochester, N. Y., on April 19.

Approximately 500 specialists in the electroplating field and related industries are expected to attend. Delegations will attend from Buffalo, Syracuse, Mohawk Valley, Capitol District and the Southern Tier.

Frank O. Beuckman, Eastman Kodak Company development engineer and president of the Rochester Branch, AES, is general chairman of the conference.

A program of six technical papers on metal and organic finishing will be presented during the afternoon at the Hotel Manger, conference headquarters. A banquet at the hotel is scheduled for the evening.

Representing the National Society at the conference will be John P. Nichols, National Executive Secretary, and other AES officers to be announced.

Dick Watson

## MEET MR. PRESIDENT

Richard O. Watson personifies young manhood in the AES. At 28, he is president of the Grand Rapids Branch. This distinction is well deserved by his activity to AES affairs. He also has served Grand Rapids Branch as a vice president, chairman of its Sustaining Membership Committee for two years and chairman of that Branch's 1957 annual party.

While a member of Detroit Branch, he was a member of the publicity committee.

Dick Watson is sales supervisor of the Wagner Brothers Inc. Grand Rapids office, which he opened when he joined the firm in 1956. Previously, he was director of the technical service laboratories at Wyandotte Chemical Corp. and had been a sales engineer in the Detroit area and in Western Michigan for Wyandotte.

He received a BS degree in chemistry from the University of Detroit, and pursued graduate courses in chemistry at Wayne State University.

Interested in golf, Dick Watson is a member of Blythefield Country Club, and somehow finds time to indulge in wood working, bridge, football and Hi-Fi. He is a Dale Carnegie Graduate Instructor.

President Watson is the proud father of two little daughters aged four and one.

## SUPREME SOCIETY HARNESSES FISCAL YEAR CHANGE

With 131 of the 169 duly elected and accredited Delegates composing the Supreme Society, highest governing council of the American Electroplaters' Society, Inc., (AES), voting by signed letter ballot, these three proposals channeled to that legislative body by the Executive Board for consideration and signed letter ballot action have been enacted as necessary expedients through which to adjust the AES to its new fiscal year (July 1–June 30 from April 1–March 31):

*PROPOSAL NO. 1*

By signed vote of 126 "Ayes" contra 1 "Nay", Bylaw amendment was made adjusting those sections of the AES Bylaws that are collateral to sections affecting the fiscal year amended by the Supreme Society at its Montreal meeting, June 20, 1957. The annexed "Bylaw Extracts" present the amended Bylaw Sections as thus amended.

*PROPOSAL NO. 2*

By signed vote of 125 "Ayes" vs 6 "Nays", it authorized National Headquarters to bill Branches for 15-months (April 1, 1958–June 30, 1959) per capita taxes, and for Branches, in turn, to bill Branch members for 15-month per capita taxes (for same period) thereby enabling the Society to adjust itself to its new fiscal year. *This, of course, is a one-time, non-recurring measure.* No dues increase of any sort is involved. It merely means that members will, *this one time*, be billed for five quarters per capita taxes instead of four as usual.

*PROPOSAL NO. 3*

By signed vote of 124 "Ayes" as against 6 "Nays", it adopted an "Interim", adjustment Society/PLATING budget covering the transition period from April 1, 1958 through June 30, 1958. The Supreme Society will consider and act upon the 12-month budget for the period, July 1, 1958–June 30, 1959, at its coming Cincinnati Annual Meeting.

These Executive Board proposals were fully and favorably considered by the Supreme Society at its Interim Meeting held in Indianapolis, January 11, 1958. Under AES law, however, the Interim Meeting is powerless to legislate. Accordingly, they were submitted for action to the 169 accredited Delegates by the Executive Board via letter ballot.

The letter ballot, together with full explanatory data and keyed return envelope, were issued to all accredited Delegates on January 14, 1958 (via Air Mail in the case of Australian, Canadian and Pacific Coast Delegates), with deadline for all returns of this so-called "Letter Ballot No. 2" necessarily set at February 4, 1958. A "follow-up" was made on February 11, 1958 of lagging Delegates so as to ensure them full opportunity to ballot on the proposals.

As at February 28, 1958, (some 45 days after letter ballot issuance on January 14, 1958), the sealed envelopes of 131 Delegates were on hand at National Headquarters.

These 131 sealed envelopes containing signed letter ballots were delivered for unsealing and count on February 28, 1958 to an official Committee appointed by National President Francis T. Eddy for this purpose by instruction of the Executive Board. Composed of Chairman Robert A. Ehrhardt (Chairman, Research Committee); Gustav Bittrich (Newark Branch First Vice President) and Mrs. Ann B. Marsh, Office Manager substituting for William A. Grigat (Newark Branch President) unable to attend, the Branch-by-Branch count certified by this committee accompanies this report.

Requiring 88 votes to enact (being two-thirds of 131 signed votes cast by accredited Delegates), the Committee, therefore, certified enactment of the respective proposals.

After unsealing, count and recording by the foregoing committee, National Headquarters assumed custodianship of these 131 signed ballots and, consequently, they are now on permanent file at the National Office.

## EXTRACTS FROM PERTINENT SECTIONS OF THE AES BYLAWS AS AMENDED BY SUPREME SOCIETY

*PART I*

ARTICLE V. DUES

*Section 1. Collection:*

Dues shall be paid in advance for the fiscal year and are payable on the first of July. Dues are payable annually in one installment, except that a member elected during the fiscal year shall pay only for the complete quarters remaining of that year.

Members of Branches shall pay dues to the Branches. The Executive Secretary shall be responsible for collection of dues from Members-at-Large and Sustaining Members.

*Section 2. Suspensions:*

A member for whom Per Capita Tax has not been paid on December 1 for the fiscal year beginning July 1 of the same calendar year shall be considered suspended until said tax shall be paid and shall not receive the official journal or other publications of the Society during suspension.

*Section 3. Per Capita Tax:*

A per Capita Tax of five dollars and seventy cents ($5.70) per annum for each member in good standing shall be paid by each Branch out of the members' dues. The tax shall be paid annually, not later than the first day of December except that for each new member of a Branch there shall be paid upon his election a tax proportionate to the number of complete quarters remaining of the fiscal year. If a Branch tax remains unpaid after thirty days from due date (January 1), Executive Secretary shall demand payment in writing, and if the tax remains unpaid after the thirty days following such demand (February 1), the Branch shall be considered not in good standing and its members shall not receive any benefits or publications of the Society until the said tax is paid. A Branch whose tax for any fiscal year shall remain unpaid thirty days after the beginning of the following fiscal year may by action of the Executive Board be suspended, and persistent failure to pay shall be grounds for revoking a Branch Charter by the Supreme Society.

*PART II*

ARTICLE III. DUTIES OF BRANCHES

*Section 4. Fiscal Year:*

The fiscal year of the Branch shall commence on the first day of July. All financial reports shall be made from, and all transactions closed to conform with the end of the fiscal year on the thirtieth day of June.

ARTICLE V. DUTIES OF BRANCH OFFICERS:

*Section 4. Secretary:*

The Secretary shall keep accurate record of all meetings of the Branch and within seven days of each meeting shall forward to the Executive Secretary a record of the meeting and copies of all appropriate papers offered for publication by the Society. He shall receive, record, and transmit for review to the Board of Managers the applications of prospective members. He shall by July 15 (April 15, 1958 this year) file with the Executive Secretary a correct list of Branch members in good standing on June 30 (March 31, 1958 this year) and shall notify the Executive Secretary monthly of any changes and additions. He shall be a member of the Employment Committee of the Society. He shall conduct the correspondence of the Branch. He shall maintain a supply of standard forms of the Society. He shall keep itemized account of the receipts and expenditures of his office and perform

such other duties as may be properly assigned him. He may be paid such compensation as the Branch shall approve.

*Section 5. Treasurer:*

The Treasurer shall receive all funds of the Branch and deposit them as directed by the Branch. He shall pay all bills properly presented for payment under the laws of the Branch and shall sign all checks. He shall give receipt for all monies received and shall keep books of account correctly posted and ready for audit. If unable to attend any meeting of the Branch, he shall arrange for a competent deputy. He shall be bonded in a sum not less than the total of funds in his charge. He may be paid such compensation as the Branch shall approve.

Before the first day of December the Treasurer shall remit to the Executive Secretary of the Society the Per Capita Tax of $5.70 due for each member of the Branch; and he shall subsequently remit upon the election of a new member a Per Capita Tax proportionate to the number of quarters remaining of the fiscal year. He shall remit to the Executive Secretary the proceeds of any duly levied Special Per Capita Tax.

ARTICLE VIII. BRANCH DUES:

*Section 1. Amount:*

The minimum annual dues of Active Members shall be $9.00 and of Student Members shall be $5.00 and shall be due and payable on the first day of July for the fiscal year ensuing. New members shall on election pay dues for the complete quarters remaining of the fiscal year during which they are elected.

*Section 2. Suspension:*

Members whose dues are not paid on the first day of December for the fiscal year beginning the first day of July shall be considered suspended until the said dues are paid and during suspension shall not be entitled to the publications or other benefits of the Society.

*Section 3. Expulsion:*

Members whose dues for the previous fiscal year are not paid at the end of any fiscal year may be expelled on recommendation of the Board of Managers and majority vote of the Branch. Such members may be again received into membership only upon due application accompanied by Application Fee and further payment of arrears acceptable to the Board of Managers.

*Section 4. Transfer:*

No member shall transfer from one Branch to another unless he is in good financial standing.

| Supreme Society Letter Ballot No. 2 (Dated 1/14/58) | Number of Delegates Accredited | Number Voted Letter Ballot No. 2 | Vote Record | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Proposal No. 1 | | Proposal No. 2 | | Proposal No. 3 | |
| | | | Aye | Nay | Aye | Nay | Aye | Nay |
| Adelaide | 3 | 2 | 2 | | 2 | | 2 | |
| Allentown-Reading | 3 | 2 | 2 | | 1 | 1 | 2 | |
| Baltimore-Washington | 3 | 3 | 3 | | 3 | | 3 | |
| Boston | 3 | 3 | 3 | | 3 | | 3 | |
| Bridgeport | 3 | 3 | 3 | | 3 | | 3 | |
| British Columbia | 3 | 2 | 2 | | 2 | | 2 | |
| Buffalo | 3 | 2 | 1 | | 2 | | 2 | |
| Capitol District | 3 | 2 | 2 | | 2 | | 2 | |
| Central Michigan | 3 | 3 | 3 | | 3 | | 3 | |
| Chicago | 3 | 2 | 2 | | 2 | | 2 | |
| Cincinnati | 3 | 3 | 3 | | 3 | | 3 | |
| Cleveland | 3 | 3 | 3 | | 3 | | 3 | |
| Columbus | 3 | 3 | 3 | | 3 | | 3 | |
| Dallas-Fort Worth | 3 | 1 | 1 | | 1 | | 1 | |
| Dayton | 3 | 3 | 3 | | 3 | | 3 | |
| Detroit | 3 | 3 | 3 | | 3 | | 3 | |
| Grand Rapids | 3 | 2 | 2 | | 2 | | 2 | |
| Hamilton | 3 | 3 | 3 | | 3 | | 3 | |
| Hartford | 3 | 2 | 2 | | 2 | | 2 | |
| Houston | 2 | 2 | 1 | | 2 | | 2 | |
| Indianapolis | 3 | 3 | 3 | | 3 | | 3 | |
| Kansas City | 3 | 1 | 1 | | 1 | | 1 | |
| Lancaster | 3 | 3 | 3 | | 3 | | 3 | |
| Los Angeles | 3 | 3 | 3 | | 3 | | 3 | |
| Louisville | 3 | 2 | 2 | | 2 | | 2 | |
| Melbourne | 3 | 1 | | | | 1 | | 1 |
| Miami | 3 | 2 | 1 | | 2 | | 2 | |
| Milwaukee | 3 | 3 | 3 | | 3 | | 3 | |
| Mississippi Valley | 3 | 1 | 1 | | 1 | | 1 | |
| Mohawk Valley | 3 | 3 | 3 | | 2 | 1 | 2 | 1 |
| Montreal | 3 | 2 | 2 | | 2 | | 2 | |
| Newark | 3 | 3 | 3 | | 3 | | 2 | 1 |
| New Haven | 3 | 3 | 3 | | 3 | | 3 | |
| New York | 3 | 2 | 2 | | 2 | | 2 | |
| Philadelphia | 3 | 3 | 3 | | 3 | | 3 | |
| Pittsburgh | 3 | 2 | 2 | | | 2 | | 2 |
| Portland | 3 | 1 | | | | | | |
| Providence-Attleboro | 3 | 2 | 2 | | 2 | | 2 | |
| Rochester | 3 | 3 | 3 | | 3 | | 3 | |
| Rockford | 3 | 2 | 2 | | 2 | | 2 | |
| Saginaw Valley | 3 | 3 | 3 | | 3 | | 3 | |
| St. Joseph Valley | 3 | 3 | 3 | | 3 | | 3 | |
| St. Louis | 3 | 3 | 3 | | 3 | | 3 | |
| San Antonio | 3 | 2 | 2 | | 2 | | 2 | |
| San Francisco | 2 | 2 | 2 | | 2 | | 2 | |
| Seattle-Puget Sound | 3 | 2 | 2 | | 2 | | 2 | |
| Southeastern | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| Southern Tier | 3 | 3 | 3 | | 3 | | 3 | |
| Springfield | 3 | 2 | 2 | | 2 | | 2 | |
| Sydney | 3 | 2 | 2 | | 2 | | 2 | |
| Syracuse | 3 | 0 | | | | | | |
| Toledo | 3 | 0 | | | | | | |
| Toronto | 3 | 3 | 3 | | 3 | | 3 | |
| Twin City | 3 | 2 | 2 | | 2 | | 2 | |
| Waterbury | 3 | 3 | 3 | | 3 | | 3 | |
| Western Ontario | 3 | 3 | 3 | | 3 | | 3 | |
| Wichita | 3 | 3 | 3 | | 3 | | 2 | |
| Total | 169 | 131 | 126 | 1 | 125 | 6 | 124 | 6 |

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By
WILLIAM TUCKER
Eastman Kodak
Rochester, N.Y.

Most of the articles listed here may be obtained by writing to the publications in which the articles were published. Addresses are given at the end of the references for the reader's convenience.

Photostat or microfilm copies of articles in available magazines may be obtained from: Library of Congress, Washington, D. C.; New York Public Library, New York; Engineering Societies' Library, New York, at prevailing rates. In other cases, consult Wilson's Union List of Serials at your nearest public library for other sources of these articles.

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Melvin R. Zell
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—Laboratory experiments are described on the electrodeposition of Cr from a bath contg. $Cr_2(SO_4)_3$ 300–400, $(NH_4)_2SO_4$ 200–300, urea 300–450 g/l and formamide 3–2 ml/l. Best results were obtained with the bath (80–100F, 25–40C) contained in a porous pot surrounded by an anolyte of diluted $H_2SO_4$.

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**Electroplating and Metal Finishing**
15 Udney Park Rd.
Teddington, Middlesex
England

**Metal Finishing**
381 Broadway
Westwood, N. J.

**Iron Age**
Chestnut & 56th St.
Philadelphia 39, Pa.

**Metal Progress**
American Society for Metals
7301 Euclid Avenue
Cleveland 3, Ohio

**J. Institute of Metals**
17 Belgrave Square
London, S. W. 1, England

**Product Engineering**
330 West 42 Street
New York 36, N. Y.

**Tin and Its Uses**
International Tin Study Groups
7 Carel van Bylandtlaan
The Hague, Netherlands



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**Modern Electroplating**
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Nonmembers $9.50 Members $

**Adhesion and Adhesives—Fundamentals and Practice**
Nonmembers $9.75 Members $

**Deterioration of Materials—Causes and Preventive Techniqu**
Edited by G. A. Greathouse and C. J. Wes
Nonmembers $12.00 Members $1

**Analysis of Electroplating and Related Solutions**
by K. R. Langford
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# INTERSOCIETY NEWS

Members of National Association of Metal Finishers who formed local branch at rally at Dinkler Plaza Hotel, Atlanta, February 15. Left to right, H. E. Willingham, M. R. McClatchey, H. R. Stogner Sr., David J. Griffin, temporary chairman; John Palik Jr., NAMF president; Robert Taylor and E. E. Sprinkle.

### NEW ASTM COMMITTEE ON SOLVENTS

The American Society for Testing Materials will increase its already extensive activity in the organic solvents field by establishing a new Committee, D-26 on halogenated organic solvents. With the approval of the Society's board of directors, an organizing committee under the chairmanship of M. A. Pinney of the Pennsylvania Railroad is undertaking the preliminary work to establish the committee which will be formally organized at the Annual Meeting of the Society during the week of June 22–27, 1958. The following scope for the new committee has been recommended:

> The promotion of knowledge pertaining to halogenated organic solvents and admixtures thereof including formulation of specifications, definitions and methods of test.
>
> Standards peculiar to electrical insulating liquids, paint thinners and non-halogenated components of admixtures normally are excluded from the scope of Committee D-26 and developments in these fields incidental to the work of Committee D-26 will be coordinated with the appropriate technical committees of the Society.

The Society has already established test methods and specifications covering many organic solvents, including such widely used materials as Stoddard solvent and a number of aromatic hydrocarbons such as benzene, toluene and xylene. The new committee will concentrate its efforts on the solvents containing halogens, that is, chlorine, fluorine, etc., including trichloroethylene, perchloroethylene and solvent mixtures containing these halogenated solvents, together with other types of organic solvents.

Subcommittees are proposed covering Definitions and Nomenclature, Vapor Degreasing, Cold Cleaning, Test Methods, and Industrial Hygiene and Safety.

A number of companies engaged in the production and use of cleaning solvents have expressed interest in participating in the committee's work. The Society welcomes participation by other companies which may be interested in this new committee. Further information on participation in the work of the committee may be obtained by writing to F. Y. Speight, ASTM, 1916 Race St., Phila. 7, Pa.

### ANNUAL MEETING OF INDUSTRIAL WASTE COMMITTEE

National Technical Task Committee on Industrial Wastes holds annual meeting at the Department of Health, Education, and Welfare, Washington, D. C. Fifty-six scientists and engineers representing major industries in the United States, and representatives of the U. S. Public Health Service convened at the headquarters of the U. S. Public Health Service December 12 and 13, 1957, for the annual meeting of the National Technical Task Committee on Industrial Wastes. Frank J. McKee of the Kraft Foods Company, Chicago, Illinois, presided. The American Electroplaters' Society was represented.

This Committee is a voluntary group formed to work with the Public Health Service of the U. S. Department of Health, Education, and Welfare to protect the nation's water resources from pollution and contamination. These meetings also provide a forum wherein the members can exchange information on the common problems of waste treatment and disposal.

Its members actively engage in research and development work on the utilization, treatment, and control of industrial wastes, and improvement of water quality controls. Emphasis is placed upon the fact that an effective national program can only be developed by means of education of public health authorities, major branches of industry, and the technical and professional societies of the country.

At the opening session, Edward F. Wilson, Assistant Secretary, Department of Health, Education, and Welfare emphasized the importance of water in the present and future economy of the United States. Leroy Burney, Surgeon General, cited the responsibility of the Public Health Service under the law and the importance of government, State and industry cooperation in the area of water pollution.

Mr. Mark Hollis, Assistant Surgeon General, pointed out that research expenditures for the years 1950–57 exceeded the total spent from 1776-1950. This had resulted in rapid industrial growth and growing waste treatment problems. Reports indicated that industry is vigorously attacking the problem and supporting a philosophy of over-all water management. The major automobile manufacturers alone have put into operation ten treatment plants in the past year.

Brig. General J. L. Person, Assistant Chief of Engineers, at a luncheon session described the activities of the Corps of Engineers. Results of projects of the Corps include the storage of water, not only for flood control purposes, but also to augment increased river flow rates which complement the activities of the U. S. Public Health Service in promoting water quality. Brig. General Person stated the rapidly increasing water requirements will result in water storage becoming a primary objective of Corps' projects in the future.

To give aid to local communities in dealing with water pollution problems created by the manufacture of new industrial products, the committee will organize a speakers bureau which will include the Nation's leading experts on water pollution control.

Research on causes of taste and odor pollutants in water supplies and methods of removing them topped a list of 27 urgent research projects which the committee recommended for study by industrial, governmental and university research laboratories.

A plan to recruit university students for careers in water pollution control was also adopted by the committee.

### NACE REGIONAL AT BOSTON IN OCTOBER

A six-symposia program for the October 5 to 8 meeting in Boston of Northeast Region, National Association of Corrosion Engineers has been announced.

Symposia will be held on cathodic protection, protective coatings, marine corrosion, zinc coatings, power industry corrosion and theory and principles.

C. E. Smith

### SMITH CHAIRMAN OF CHICAGO ELECTRO-PLATERS

The newly elected officers of the Chicago Electro-Platers Institute are: C. E. Smith, B. Mercil & Sons Plating Company and Mercil Plating Equipment, chairman; George Strom, Ada Plating Works, vice chairman; and Louis P. Lanz, Northwestern Plating Works, secretary-treasurer.

Directors elected at the recent Annual Meeting are: Harold W. Baker, Electro Galvanizing Company; R. H. Rahe, Chromium Corporation of America; William Bott, Aetna Plating Works, Inc.; William Crawford, Chrome-Rite Company; Emil Van Steen, The Modern Plating Company; William Carlson, Arrow Plating Company; Joseph Gruzdis, Brookline Electro-Platers, Inc.; and Phil Ritzenthaler, Plating Engineering Company, West Allis, Wisconsin.

The Chicago Electro-Platers Institute, an association of job shop metal finishing establishments comprising eighty companies in Illinois, Iowa and Wisconsin, is in its twenty-third year of operation.

### MEMBERSHIP RALLY SPURS NAMF DRIVE

A new local formation in Atlanta, Georgia, February 15, featured the two-day session of the National Association of Metal Finishers' executive committee in that city.

Close to two dozen shop owners and firm representatives attended the membership rally at the Dinkler Plaza Hotel. Under the direction of NAMF board member George W. Taylor, Production Plating Co., Adel, Georgia, the rally—a highlight of the current NAMF drive for new members—also sparked chances of a local formation in Florida.

Special guests included members of the NAMF executive committee and board of directors who addressed members briefly at a luncheon meeting. NAMF-er David J. Griffin, Birmingham Plating Works, Inc., Birmingham, Alabama, was elected temporary chairman of the new local.

NAMF president, John Palik Jr., of Cleveland, expressed "great satisfaction and pleasure" as he congratulated members of the new local. He paid particular tribute to George W. Taylor for his "untiring efforts and dynamic action." Mr. Palik, on behalf of the NAMF executive committee, thanked Mr. Taylor, his co-workers and AES Southeastern Branch for "Southern hospitality at its most magnificent best."

The new Atlanta-formed NAMF local includes the following members: Southern Plating Co., Inc., Anniston, Ala. (H. E. Willingham); Dixie Plating Co., Inc., Cookeville, Tenn. (E. E. Sprinkle); Atlanta Plating Works, Atlanta (H. R. Stogner Sr.); Southern Aluminum Finishing Co., Atlanta (M. R. McClatchey); Power Plating, Inc., La Grange, Ga. (C. N. Shearer); Production Plating, Adel, Ga. (George & Robert Taylor); and Birmingham Plating Works, Birmingham, Ala. (D. J. Griffin).

### NAMF EXTENDS CONVENTION TO THREE DAYS

A two-day educational session and management seminar instead of the usual one day highlights this year's convention of the National Association of Metal Finishers according to a NAMF release. The additional day brings the total of convention days to three—May 18, 19, and 20.

As has been the custom, the NAMF conclave is being held concurrent with that of the AES, with headquarters and activities at the Sheraton-Gibson Hotel, Cincinnati.

An annual meeting of members on Sunday will open the three-day convention. President John Palik Jr. of National Plating Corp., Cleveland, Ohio, is slated to rap his gavel at 9:30 a.m. The NAMF Board of Directors will convene at 1:30 p.m., that same day, and will elect their 1958–1959 officers.

Monday should find shop owners and operators "talking shop" as the first day's educational program gets under way with A. T. Leonard, president of Superior Plating, Inc., Minneapolis, Minn., serving as moderator. The two-day session includes: Monday—Rust Proofing, Barrel: Bruce Roberts, Siegel-Roberts Plating Co., St. Louis, Mo.; Glenn H. Friedt Jr., United Platers, Inc., Detroit, Mich.; Rust Proofing, Rack: John Lietz, B. Mercil & Sons Plating Co. and Lawrence J. Hay, Plating Service Co., both of Chicago, Ill.; Tuesday—Decorative Plating: Mariano Ranno, Imperial Plating Co., Brooklyn, N. Y.; Lewis T. Briggs Jr., Erie Plating Co., Erie, Pa.; Hard Chrome Plating: Duke L. Saas, Atlas Hard Chrome Service and John Hyduke, Durable Plating Co., both of Cleveland, O.

Meanwhile, back in their hotel rooms, the ladies will be primping for the traditional cocktail party, reception and banquet, Tuesday evening. According to General Chairman W. Wilson Loveless, vice president of Varland Metal Service, Inc., Cincinnati, O., a top-flight "name" speaker is slated who should please both members and their wives, thus bringing to a fitting climax three full days of fun, education and fellowship.

### PURDUE INDUSTRIAL WASTE CONFERENCE

The 13th Purdue Industrial Waste Conference will be held May 5, 6 and 7 in the Purdue Memorial Union Building at Purdue University, Lafayette, Indiana. Approximately 50 papers on recent developments in the treatment, analysis and control of industrial wastes will be delivered.

All interested persons are invited to attend. Hotel reservations may be made with the Purdue Union Club, Fowler Hotel, Cedar Crest Hotel, Morris Bryant Hotel or Devon Plaza Motel.

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### E. STEEN THOMPSON

The AES has been saddened by the death on February 21 of E. Steen Thompson of Erie, Pennsylvania, a Past National President of the Society.

Long a member of the Society who rendered distinguished service at both Branch and National levels, Mr. Thompson headed the Society in 1936–37 and was President of Cleveland Branch 1930–33. He was associated in scientific control with the Hays Manufacturing Company of Erie.

The Society grieves the loss of this devoted stalwart.

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# PATENT ABSTRACTS

**DR. D. GARDNER FOULKE**
Manager, Electrochemical Development
Hanson-Van Winkle-Munning Co
Matawan, New Jersey


**Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.**

**No. 2,814,574, 11/26/57—Black Coatings**—G. Freeman and K. Berberian—assignors to Raytheon Mfg. Co., Waltham, Massachusetts.

A black coating can be put on metallic bodies by applying to the body a mixture of 21 per cent titanium dioxide, and at least one of the oxides of iron and nickel, 78 per cent of a nitro-cellulose binder and 1 per cent of wetting agent. Finally, heat the body to 1350 C. and cool.

12 claims.

**No. 2,814,576, 11/26/57—Dyeing Anodized Aluminum**—C. Zickendrahb and R. Wittever, Assignors to Ciba, Ltd., Basel, Switzerland.

A process for fast dyeing anodically oxidized aluminum is claimed in which the anodized aluminum is immersed in an aqueous bath containing a copper or cobalt complex of a monoazo dyestuff corresponding to the formula

$$\left[\begin{array}{cc} OH & OH \\ | & | \\ HO_3S—R_1—N = & NR_2 \end{array}\right]—(SO_3H)_n$$

where n = at least 2
$R_1$ = benzene radical
$R_2$ = hydroxynaphthalene or hydroxy quinoline

10 claims.

**No. 2,814,577, 11/26/57—Aluminum Conversion Coating**—N. Newhard Jr., assignor to American Chemical Paint Co., Ambler, Pa.

An aqueous acid coating solution for forming a conversion coating on aluminum consists essentially of fluoride ions, chromate ions and ions from the class of phosphates and arsenates may be replenished by adding said ions in the necessary amounts as controlled by weight loss on a standard piece of glass immersed for a given time at constant temperature in a sample of the bath.

1 claim.

**No. 2,814,589, 11/26/57—Plating on Silicon**—M. Walz, assignor to Bell Telephone Laboratories, Inc., New York, N. Y.

Electroplate a gold-antimony layer on the silicon wafer, heat to 920 C to form a An-Sb-Si alloy bond, then deposit copper on the Au-Sb layer by displacement of copper thereon from a copper sulfate-hydrofluoric acid electrolyte.

3 claims.

**No. 2,814,590, 11/26/57—Electrodeposition of Copper**—L. Portzer and W. Leitenberger, Rocky River, Ohio.

To a Rochelle salt—copper cyanide bath add a selenium chelate (soluble selenium compound reacted with ethylene diamine tetra-acetic acid) in amounts greater than 0.1 g/gal and a similar


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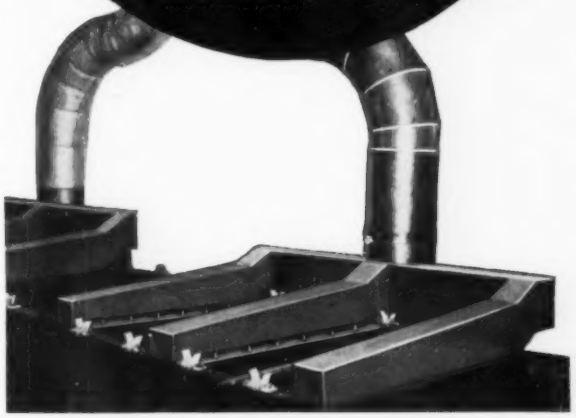

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lead chelate compound (0.01 g/gal). Another claim describes the selenium chelate as a compound obtained by reacting a soluble selenium compound with a reaction product obtained by reacting an aliphatic amine having at least one replaceable hydrogen atom attached directly to an amino nitrogen atom with an alkali metal cyanide and a formaldehyde yielding substance.

16 claims.

**No. 2,814,591, 11/26/57—Electrolytic Manganese**—R. Dean, Hyattsville, Md.

Addition of reducing agents, such as hydrazine salts and hydroxylamine salts, to ammonium chloride—sulfite manganese electrolytes is claimed to be helpful.

3 claims.

**No. 2,814,593, 11/26/57—Corrosion Inhibition**—J. Beiswanger, assignor to General Aniline and Film Corp., New York, N. Y.

Aqueous solutions normally corrosive to metal surfaces may have this action inhibited by the addition of (A) a water-insoluble N-heterocyclic base and (B) a water-soluble non-ionic surface active agent containing a polyoxyethylene group.

17 claims.

**No. 2,815,298, 12/3/57—Silvering Mirrors**—H. Heffley, assignor to The Toledo Plate and Window Glass Co., Toledo, Ohio.

An apparatus for silvering glass to make mirrors by chemical reduction is described.

5 claims.

**No. 2,815,299, 12/3/57—Molybdenum Coating**—P. Raymond, assignor to National Research Corp., Cambridge, Mass.

Molybdenum is deposited on a basis metal, after providing a coating of a metal (Cr, Ni) capable of forming a diffusion bond, by reduction of molybdenum pentachloride with hydrogen. The improvement consists of bubbling an inert gas through the molybdenum pentachloride.

4 claims, figure.

**No. 2,815,302, 12/3/57—Film Resistors**—B. Ostrofsky and J. Ballard, assignors to The Commonwealth Engineering Co., Dayton, Ohio.

Electrical resistors can be made by depositing chromium from the gas phase (carbonyl) on glass and subsequently heating to red heat in the evacuated chamber.

10 claims, figure.

**No. 2,815,609, 12/3/57—Deburring and Polishing Machine**—A. von der Linden, Newark, and Steve Yacus, Warren Township, N. J.

An apparatus for deburring consisting of housing, pan and a reciprocating shaft to which work pieces can be attached.

5 claims, figure.

**No. 2,816,048, 12/10/57—Forming Chromium Alloys on Surfaces**—P. Galmiche, assignor Office National d'Etudis et de Recherches Aeronautiques, France.

A superficial alloy can be formed on the surface of a metallic body (Fe, Ni, Co) by bringing the body at a temperature of at least 600 C into contact with chromium fluoride vapor in the presence of hydrogen.

18 claims.


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**No. 2,816,066, December 10, 1957—Method of Plating**—A. Russell, assignor to Western Electric Co., New York, N. Y.

The method refers especially to articles of molybdenum, tungsten, cobalt, and alloys thereof, and consists of gold striking (0.00001–0.0001 in.), heat-treating at 2000–2500F, then electroplating the heat treated article.

1 claim.

**No. 2,816,403, December 17, 1957—Buff**—R. Peterson, assignor to The Osborn Mfg. Co., Cleveland, Ohio.

A rotary buff comprising a circularized metal channelform back opening radially outwardly, and buff material retained therein and extending generally therefrom comprising pairs of fabric discs joined at their centers and separated otherwise to form pairs of generally conical tubular pleated fingers, said pairs of fingers, being stitched to a continuous fabric strip in the regions of their joining to interconncet said pairs of fingers, stripes of abrasive material adhered to said buff material intermediate the lines of folding of such pleats only, and an elongated retaining member within said channelform back overlying such strip and such pairs of fingers in their region of joining to secure the same in said back with said fingers extending generally radially therefrom in side-by-side relationship.

6 claims.

**No. 2,816,819, December 17, 1957—Removing Ferrous Sulfate from Solutions containing Nickel and/or Cobalt**—A. Wallis and D. West, assignors to The International Nickel Co., New York, N. Y.

Pass ozygen and sulfur dioxide into the bath at a *p*H of 3–5. Add nickel (cobalt) hydroxide or carbonate and precipitate the ferric hydroxide.

4 claims.

**No. 2,816,824, December 17, 1957—Cerium Oxide Polishing Composition**—H. Wilansky, assignor to Corning Glass Works, Corning, N. Y.

Cerium oxide, especially good for polishing glass can be kept from caking by adding a small (0.3–0.5 per cent) amount of water insoluble metal silicate to the aqueous cerium dispersion.

4 claims.

**No. 2,816,846, December 17, 1957—Chemical Nickel Plating**—P. Talmey, assignor to General American Transportation Corp., Chicago, Ill.

A method of chemically plating large containers by injecting the hot hypophosphate—nickel solution into the container which is rotated.

11 claims.

**No. 2,817,141, December 24, 1957—Composite Metal Structure**—H. Toulmin, Jr., assignor to Commonwealth Engineering Co., Dayton, Ohio.

A new article of manufacture, as continuous metal casting having a non-ferrous, gas-plated coating thereon, is described. The metal is plated on the casting as it is cast and before it comes in contact with an oxidizing atmosphere.

6 claims, figure.

**No. 2,817,195, December 24, 1957—Cleaning Metal Surfaces**—L. Curtin, Cranbury, N. J.

Dirt, oil, rust, etc. may be removed from metal surfaces by spraying with a slurry of finely divided abrasive material suspended in an aqueous solution containing one of the class of hydroxides, silicates, non-ionic and anionic surfactants, soap and sequestering agents. The pressure at the spray nozzle must be at least 20 psi.

2 claims.

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# EQUIPMENT AND SUPPLIES

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**E—401. Portable Precision Plater**—A unit measuring only 34 by 28 by 33 in. contains all the equipment and features for precision-plating of electrical or electronic parts, specification precious metals plating, or "pilot plant" set-ups, according to an announcement from Sel-Rex Corporation. A completely re-designed version of this firm's Jet Plater, the new models are said to permit either barrel or rack plating with any cold alkaline solution, and most acid plating solutions, on a mass-production basis.

According to Sel-Rex, the new Jet Platers provide the ideal operation for precision-plating; i.e., a stainless steel, canned turbine pump, in conjunction with a vinyl, jet orific manifold at the bottom of the plating tank, causes the plating solution to swirl constantly around the work, assuring smooth, even deposits. In operation, the solution is continuously drawn off from the bottom of the tank, circulated through the pump and built-in filter, and returned to the tank under pressure.

It is reported that the units are completely automatic—all operations being controlled from convenient panel board which incorporates dual scale ammeter, powerstat control for rectifier, circuit breakers, and automatic timer which sounds alarm upon completion of plating cycle.

In addition to the space saving convenience of a complete plating "plant" in a compact package, Sel-Rex states the Jet Plater permits increased production work without sacrifice of quality.

**E—402. Zinc Brighteners**—Allied Research Products, Inc. has announced the introduction of two new brighteners for cyanide zinc plating solutions—ARP 32, a powdered addition agent which provides brightness over the entire normal plating range found in still and automatic tanks—and ARP 53, a low cost liquid addition agent for barrel plating.

ARP 32 is said to give an excellent, uniformly bright plate over current densities ranging from the lowest encountered in still plating to as high as 70 amps. It provides fine grained deposits which will bright dip in nitric acid or chromate bright dips. Excellent throwing power, good coverage and brightness in recesses and in hard-to-reach areas are claimed.

ARP 53 is reported to have a wide current density range that provides brightness for barrel plating operations both in recesses and on outside areas. This brightness is of a degree which is usually acceptable even without bright dipping, but has an exceptional clarity and sparkle after bright dipping in either one half per cent nitric acid or chromate bright dips.

**E—403. Plastic Pump**—Vanton Pump & Equipment Corp. announced that a new Marlex 50 polyethylene pump has been added to their plastic sealless pump line.

The new construction is said to make it possible to handle extremely corrosive fluids at temperatures up to 260F. Conventional polyethylene is limited to 140F service preventing its use under conditions of elevated temperature operation or services requiring sterilization or boiling.

In addition to the increased temperature range the new material possesses a close dense molecular structure which is reported to result in high tensile strength and low permeability.

**E—404. Abrasive Wheel**—For polishing and finishing contoured as well as flat metal surfaces, a versatile new flap wheel has been developed by Behr-Manning Co. It is made up of hundreds of pieces of coated abrasive cloth, with a stiffened construction to allow it to resist pressure.

The new wheel is particularly suited for use on fully automatic polishing jack operations. Also, it may be used on any standard bench grinder in place of a wire brush for the many small polishing jobs required in the ordinary garage, and can serve in the body shop to clean up solder jobs or rusty panels.

In automobile and appliance manufacture, it is useful for smoothing out grit lines and swirl marks after discing.

The flap wheel is furnished with aluminum oxide or silicon carbide abrasive in a wide range of grit sizes, a variety of hole sizes and in wheel sizes from 6 by 1 up to 16 by 6 in. Ten in. and smaller wheels are furnished with built-in disposable metal flanges. Each wheel is marked with an arrow to show direction of rotation, and stamped with the maximum permissible speed.

**E—405. Lead Foil Tape**—Permacel-LePage's Inc., has announced a new pressure sensitive lead foil tape, which is used primarily in electroplating work as a stop-off tape to mask off parts which are not to be plated.

Designated as Permacel EI 3879, the new tape features easy release of its polyethylene liner, which permits quick application. A specially compounded lead foil combined with a pressure sensitive adhesive and the new liner make the tape useful in a number of applications.

Overall thickness of the new tape is 6.0 mils. Tensile strength (no liner) is 18 lbs/in., and elongation is 10–12 per cent. Adhesion to liner 19 ozs/in, and adhesion to steel is 32 ozs/in.

*A 3M Case History Report*

# STEEL POLISHING SPEEDED 10–15% WITH "PG" WHEELS

**MANUFACTURER:** Heintz Division of Kelsey-Hayes Co.

**ADDRESS:** Philadelphia, Pennsylvania.

**PRODUCT MANUFACTURED:** Automotive Metal Stampings.

**3M ABRASIVE USED:** "PG" Wheels.

**HOW 3M ABRASIVES ARE USED:** Finishing operation. Remove die marks, scratches, and other forming defects from cold-rolled carbon steel auto grille bars, prior to plating.

**OPERATIONAL DATA ON 3M METHOD:** Grit 220 Resin Bond Cloth "PG" Wheel on double-spindle floor lathe with buff-wheel.

**OPERATIONAL DATA ON PREVIOUS METHOD:** 2-station, 3-step method. 1st, #120 disc; 2nd, set-up wheel; 3rd, buff-wheel.

**PROVEN ADVANTAGES OF 3M METHOD:** Former 3-step operation reduced to 2 steps; "PG" Wheel and Buff. "PG" Wheel leaves no scratches on work piece; speeds production 10-15%.

**OTHER 3M ABRASIVE PRODUCTS IN USE:** "Three-M-ite" Resin Bond Cloth Portable "PG" Wheels on hand-grinders are used to remove in-use scratches, other imperfections from dies, without removing them from press. "PG" Wheels replaced hand methods, reduced repair time from 14 hours to 30 minutes.

**WANT MORE INFORMATION?** Send for free manual, "Modern Metal Finishing with 3M 'PG' Wheels." Write to 3M Co., St. Paul 6, Minn., Dept. MR-48.

"PG" Wheels are manufactured in U.S.A. by 3M Company, St. Paul 6, Minn. Export: 99 Park Avenue, New York. Canada: London, Ontario

## 3M Coated Abrasives

**"PG" WHEELS**

**MINNESOTA MINING AND MANUFACTURING COMPANY**

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## PREVIEW OF FUTURE PLATING ISSUES

●

**MAY 1958**

CONVENTION ISSUE. Inasmuch as the 1958 Annual Convention will be held in Cincinnati, Ohio, May 19–22, this feature issue will come in May instead of June as customary.

●

**JULY 1958**

POST CONVENTION ISSUE. Among other features, it will contain a pictorial and narrative account of the 45th Annual Convention.

●

**AUGUST 1958**

WATER AND WASTE TREATMENT. Another edition of this informative and popular feature.

●

**NOVEMBER 1958**

AIRCRAFT. Electroplating and metal finishing in the aviation industry will be featured in this second annual edition.

●

THE JUNE, SEPTEMBER, OCTOBER and DECEMBER issues loom as strong 1958 General Issues.

●

**JANUARY 1959**

ABRASIVES AND MECHANICAL FINISHING. Developments in the various finishing methods will be featured in this annual issue.

**E—406. Brass Filter**—New single-tube Fulflo filter for compressed air is made from nickel-plated brass to eliminate possibility of iron contamination or rust. 7-in. honeycomb filter tubes provide depth filtration to minimize gumming and remove moisture, oil, microscopic rust and dirt particles. Flow rates are 50 cfm (free air) at 40 psi; 70 cfm at 80 psi; 76 cfm at 100 psi. Streamlined head with single center bolt provides for speedy servicing. Filter is supplied with or without mounting bracket for $\frac{3}{8}$ inch or $\frac{3}{4}$ inch pipes. These tubes are available in a wide range of controlled densities to provide the exact degree of micro-clarity needed for each operation.

**E—407. Cycle Timer**—The Series 306 Duo-Set timer is now being manufactured by Automatic Timing and Controls, Inc.

Operating on the reversible motor principle, it is reported to combine simplicity with accuracy and dependability. Synchronous motor drives elapsed time indicator up scale and down scale to setting pointers. Reversal is self-synchronizing. The timer controls two independently adjusted load circuits for off-on cycling over entire dial range. It may be mounted in any position.

**E—408. Coating**—Titanine, Inc. announces the development of Stopoff M-705, a quick-dry chemical-resistant coating designed to withstand the action of high speed, high caustic copper plating baths. It is claimed to be particularly effective against cathodic hydrogen bubbling developed when using high current densities for extended periods, or normal bright plating in the copper-nickel-chrome cycle. After use, the coating may be quickly and effectively removed with simple solvents, it is reported.

**E—409. Stripping Solution**—A chemically stable solution that will selectively strip nickel plate from any basis metals was announced by Hanson-Van Winkle-Munning Co. Stability of the solution makes it feasible to maintain a bath on a stand-by basis for immediate reclamation of rejects.

The solution is made up of one part Ni-Plex A and one and one-half parts Ni-Plex B to five and one-half parts water.

Because of its high chemical selectivity, it is suitable for stripping all types of electrolytically deposited nickel and nickel-cobalt plating from any combination of basis metals without masking. It contains no cyanide and no caustic, is non-toxic and reasonably safe to handle.

**E—410. Test Kits**—Two simplified analytical test kits for Diamond CPA-1800 chrome plating additive have been developed by the laboratory staff of Kocour Co. in cooperation with Diamond Alkali Co.

The kits are said to bring to the electroplating industry a newly developed analytical technique or procedure that substantially shortens testing time on chromic acid and the diamond chromium plating additive with no loss of accuracy.

CPA Kit, used for determining the concentration of Diamond CPA-1800 only in chrome-plating baths, contains solutions to make approximately 25 tests and includes a standard chromic acid—CPA-1800 solution for checking the end point. CPA-CA is a combination kit used for determining concentration of both CPA-1800 and chromic acid.

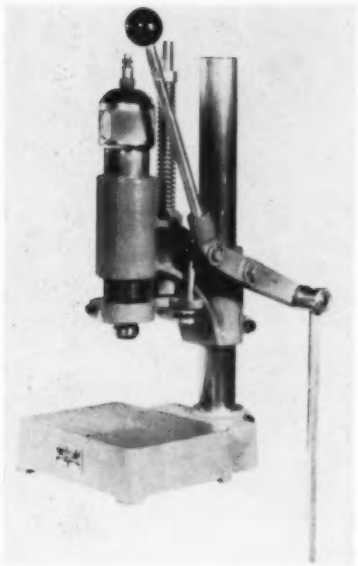
**E—411. Wet Dust Collector**—Wheelabrator Corp. has added another product to its line.

This latest development is the wet dust collector which, after extensive testing, is said to show an excellent efficiency performance. It has no moving parts, no nozzles or pumps and delivers discharge air free of entrained water.

**E—412. Air Hammer**—A new vibrating air hammer for electroplaters has been developed by Heidrich-Nourse Co.

The machine is used to remove the accumulation of plating from the wire or flat tips of the plating racks.

The machine operates on the principle of a repeating air hammer. Operation normally is by foot pedal to bring the hammer cylinder with the impact tool down onto the work and hold it there dur-



ing the work cycle. Valving is internal and is actuated by contact pressure. So long as the contact pressure is maintained the hammer will repeat at from 2000 to 6000 times per min, depending on the air pressure used. Upon release of the foot pedal the hammer cylinder is lifted up away from the work. At 20 lb psi the hammer has a gentle vibrating action for light work. In the range from 20 to 80 lb pressure the hammer will break loose tough plating deposits.

**E—413. Laboratory Hood**—The availability of laboratory hoods constructed of polyvinyl chloride materials throughout was announced today by the Kaykor Industries Division of Kaye-Tex mfg. Corp. The hoods should prove especially useful wherever highly corrosive or radioactive materials are encountered.

All vinyl parts, including the white vinyl backpiece and transparent unplasticized polyvinyl chloride skylight are reported to withstand a broad range of highly corrosive acids, alkalies, and organic media. Since the material is easily decontaminated by standard procedures, the hoods are suitable for radioactive work.

**E—414. Abrasive Discs**—Coated Abrasives, Inc., announces the availability of their new line of Shur-Stik abrasive discs and disc holders for flat or contour grinding and polishing operations.

The discs require no center nut. They are attached by a special adhesive on the back of the disc and disc holder. This allows the operator to change the spent disc or a grit size without unfastening a center nut or applying an adhesive.

The discs reportedly will not stick together when handled singly but will adhere to the rubber holder when in use due to their waffle backing.

They are available in sizes from ½ to 20 in. diameter and in a full range of grit sizes.

**E—415. Current Transducer**—Rapid Electric's dc current transducer consists of a window-type ac current transformer through which the dc bus bar or cable is passed.

Current ranges vary from 500 to 500,000 amp with an accuracy of 0.5 to 1 per cent.

The transducer is furnished with isolation transformer ac current transformer (T-2) selenium rectifier (RC), meter instrument, pilot light, and on-off switch (S-1). All items, with the exception of the ac current transformer are housed in a metal cabinet measuring 8 by 14 by 8 in.

The ac current transformer consists of two saturable core reactors which are magnetically coupled to the dc bus. This transformer produces an ac signal that is linearly proportional to the magnitude of the dc in the bus bar. Since dc power cannot be transmitted across a magnetic circuit, separate excitation voltage is supplied to the secondary by the isolation transformer (T-1).

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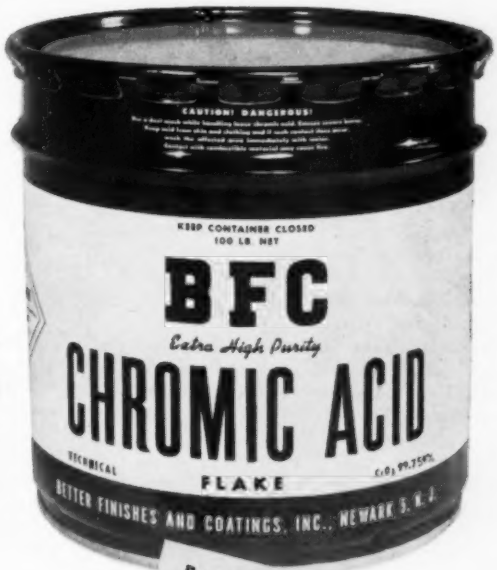
JUST CALL . . .

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Regular Flake—Thin Flake—Ground—whatever your Chromic Acid needs, we can supply them—promptly. Fast shipments from plant and nearby distributor stocks. All extra high quality 99.75+% pure.

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 429.

**L—401. Conveyors**—The part played by mass-production conveyors in the growing automation of metal finishing is described in a new four-page, two-color bulletin offered by Hanson-Van Winkle-Munning Co.

Featuring over a dozen photographs of actual in-plant adaptations of the extensive line of electroplating and anodizing conveyors made by H-VW-M, Bulletin FAC-103 concisely describes these applications in terms of their flexibility and efficiency. Strides toward full automation made possible by recent advances in automatic barrel plating are also indicated.

A special section of the bulletin explains the system which allows nine or more anodizing or plating operations to be carried out automatically under the control of one operator. Also described is a new automatic load-unload for transfer points.

**L-402. Conversion Coatings**—A new eight-page brochure describing various chemical conversion coatings for steel, aluminum, galvanized iron, zinc and cadmium plated surfaces; for corrosion resistance, paint bonding, drawing and forming, and protection for friction surfaces is available from American Chemical Paint Co. Also listed are current specification chemicals for the Government and its contractors.

**L—403. Cleaning Compound**—A four-page brochure describing Grease-Ban, water emulsifiable and cleaning compound, has been issued by Parke-Hill Chemical Corp. In addition to describing the degreasing, cleaning, and disinfecting properties of the compound, the brochure tells how it is used for degreasing metals and metal products and for general plant maintenance.

**L—404. Finishing Machines**—A new catalog of the Mecha-Finish Corp. describes a complete line of precision mechanical finishing equipment, and the processing media and compounds to be used in the equipment.

The machines are designed to provide volume production finishing of parts too large, too intricate, or delicate for other finishing methods. They utilize a rotating spindle to hold the part which is then immersed in an abrasive mass. The complete finishing cycle averages 15 to 20 sec.

The entire Mechamatic process and its engineering features are described in the illustrated booklet.

**L—405. Silicon Rectifier Equipment**—Bulletin GEC-1485, four pages, describes extra features of high-quality, "self-protected," silicon power conversion units designed for general purpose industrial and commercial applications. It includes power supply for cranes, elevators, machine tools and other applications requiring 250-volt d-c current up to 600 kw. Application data, ratings, "self protection" features, and performance data are included with photos, charts, and graphs to illustrate the material.

**L—406. Rubberized Abrasives**—Rubberized abrasives for deburring, smoothing and polishing applications are thoroughly covered in the latest Cratex Industrial Catalog just published.

The new catalog tells what these rubberized abrasives are, how they are used and what they can do on a broad list of high precision manufacturing operations on tools, dies, molds, instruments, models and component parts. In its eight pages are to be found advanced application information, operating instructions, tables, illustrations and other technical information.

**L—407. Finishing Equipment**—Bulletin 600 is the newest catalog describing the line of Schmieg finishing equipment. It approaches finishing problems from both the viewpoint of the large producer and the smaller concern. Complete systems are explained. The bulletin is also helpful to a buyer of a single item, such as a washer, oven or paint spray booth. Featured in this bulletin is the inclusion of many isometric drawings of different types of finishing equipment.

**L—408. Blast Cleaning**—A 28-page handbook of blast cleaning, finishing and shot peening ideas utilizing the airless abrasive blast method is available from Whellabrator Corp.

A special section of this comprehensive handbook is devoted to the versatility of applications of airless abrasive blast equipment in which more than 50 case history accounts are included. Covered are such diverse applications as cleaning of castings, forgings and heat treated parts; deflashing of plastic moldings; reconditioning of auto parts, brake shoes, gas cylinders, and steel drums.

The balance of the booklet is devoted to specific types of blast cleaning machines describing their applications, features and specifications.

**L—409. Process Card**—The Esbec Barrel Finishing Corp. issues a Process Card. It also serves as a time-study record of the barrel finishing operations on each part. Both records are combined on the front of a sturdy 8 x 5 in. card.

It provides spaces for the description of the part, the barrel to be used, and the number of parts per load. It also has spaces for every conceivable barrel finishing operation, as well as the media and compounds used, water height and rpm.

Once the cycle has been determined and entered on the card, any operator can follow it.

Combined with this processing information are spaces for recording the time of each operation; such as, loading, running, rinsing, unloading and separating. This time record permits accurate barrel finishing costs to be obtained.

On the back of the card are spaces for recording repetitive runs of the same part and for any special instructions which may be necessary.

---

## American Society of Testing Materials

(*Continued from page 341*)

3. Ni-rinse-Ni
4. Ni-rinse-dry-activate-Ni
5. Ni-anodic alkaline treatment-activate-Ni
6. Ni (soln. 1)-Ni (Soln. 2)

Four nickel solutions and five pre-plating etches will be considered.

*Section W (Industrial Water):*
Chairman—H. KAFARSKI

A chart of water-borne impurities has been prepared, and will be distributed to Sub-IV members by Summer.

*Sub-V (Organic Coatings):*
Chairman—G. E. BEST

*Section B (Chromated Zn):*
Chairman—A. MENDIZZA

Testing work is now underway. It appears that humidity cycling alone does not produce much corrosion, a contaminant in the air is required.

*Section D (Chromated Cd):*
Chairman—L. GILBERT

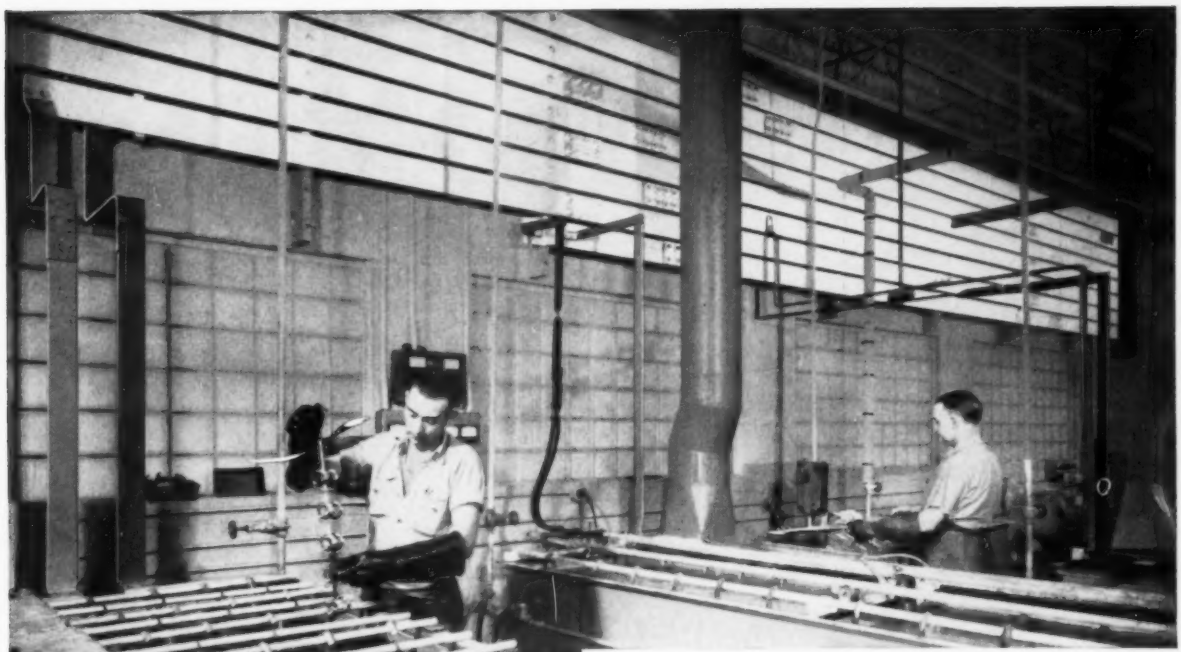
The samples are now on test. Some of the samples have already begun to rust.

*Section E (Phosphate Coatings):*
Chairman—S. SPRING

Tests are being made on phosphatized steel in aerated water (Springfield test). While the test is designed for heavy coatings, it will be used for correlating porosity and continuity of the type of thin coatings used in pre-painting treatments.

*Section H (Treatments on Al, Mg):*
Chairman—C. W. OSTRANDER

This section has just been formed, and is now organizing its work.



On the rear wall is the Alcoa Aluminum Bus Conductor system on still tanks and automatic plating machines in Z & W's plating department. Over $3,000 was saved in material costs alone.

# $3,000 IN DIRECT SAVINGS

## With Alcoa Aluminum Bus Conductor at Z & W Manufacturing

When Z & W Manufacturing Corporation designed their new 130,000 sq ft plant in Wickliffe, Ohio, they wanted equipment second to none—yet costs were closely watched. One of the best of the money-saving acts took place in their plating department.

After a detailed study, they used Alcoa® Aluminum Bus Conductor to carry the 12,000-amp load from individual rectifiers to the six plating lines. Compared to a copper system Z & W got the same conductivity from half as many pounds of metal. Only difference was a slight increase in size. In installing a system using high-conductivity aluminum alloy, Z & W estimates they saved more than $3,000 in direct material costs alone.

### Easy fabrication and installation

Other important benefits and savings resulted from aluminum's light weight and easy handling. Also important was the ease of fabrication during their bending and drilling operations. The ½" x 6" bars were just bolted to 2 x 8's attached to the wall. Simple insulating washers and wood spacers were used.

Having some small copper bar stock on hand, they used that as leads in some places—other leads were aluminum. Trouble-free joints between copper and aluminum were made, as were all joints, with Alcoa Electrical Joint Compound and aluminum bolts.

### Saves 50% on bus conductor

The same technical advice and assistance from Alcoa that enabled Z & W to engineer, design, fabricate and install this bus system are yours for the asking. Study how much you could save with Alcoa Bus Conductor—for expansion or modernization. Cost is about half. Alcoa Bus Conductor is available for immediate delivery from your Alcoa distributor. Look under Aluminum in the Yellow Pages of your phone book. Or write, Aluminum Company of America, 2313-E Alcoa Building, Pgh. 19, Pa.

"ALCOA THEATRE"
EXCITING ADVENTURE
ALTERNATE MONDAY EVENINGS

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

*Your Guide to the Best in Aluminum Value*

# INDUSTRY NEWS

### L'HOMMEDIEU TO HANDLE BARRETT CHEMICAL IN WEST

The Barrett Chemical Products Co. Inc. of Shelton, Connecticut, manufacturers of the Barrett sulfamate nickel plating process and allied products announces the appointment of the Los Angeles branch office of the Chas. F. L'Hommedieu & Sons Co. as a distributor and technical service representative in California, Arizona and New Mexico.

The L'Hommedieu branch office in Los Angeles, under the direction of Lawrence O'Niel, handles a complete line of materials for the polishing and plating industry. Warehouse stocks are maintained and analysis service provided for customers.

Technical service concerning Barrett products will be under the personal direction of Harvey K. Hunt who has worked in the area with Barrett products for a number of years.

### WYANDOTTE CALIFORNIA DISTRICT WINS AWARD

Tom Todd, Los Angeles district sales manager, received a first place award at the annual district sales managers conference of the J. B. Ford Division of Wyandotte Chemicals Corp. at The Greenbrier, White Sulphur Springs, West Va. On behalf of the California district sales-service force, Mr. Todd was awarded a certificate for achieving first place in selling the company's Industrial and Aircraft Department products. The presentation was made by P. N. Burkard, manager of the department.

### H-VW-M REORGANIZES ENGINEERING DIVISION

A major reorganization of its engineering division has been announced by Hanson-Van Winkle-Munning Co., manufacturers of anodizing and electroplating systems.

Under the new program, greater emphasis will be placed on development of new and improved methods in the anodizing and electroplating fields. In addition, increased research in the field of new products and equipment is planned.

To implement the increased emphasis on research and development, the company is building new mechanical and electrical laboratory facilities and expanding facilities of its electrochemical laboratory.

A completely integrated company, H-VW-M design and build all of their own equipment, including electric generators and rectifiers. The electrical division has been growing rapidly, and the firm now markets generators and rectifiers outside the electroplating and anodizing fields.

### SOLVAY PROCESS OPENS NEW SODA ASH PLANT

Solvay Process Division, Allied Chemical, has completed a new dense soda ash plant at Baton Rouge, La. The new facilities more than double previous capacity.

The plant is now in a position to further extend its service to customers in the southern part of the United States. Shipments by rail, truck or water movement can be made at once from the new installation.

The newest addition to the plant constitutes the fourth expansion of soda ash capacity since Solvay began operations at Baton Rouge in 1935. Other Solvay soda ash plants are located at Syracuse, New York, and Detroit, Michigan.

### CONVERSION CHEMICAL LICENSES CANADIAN FIRM

Conversion Chemical Corp. licensed Nicromatic Limited, 20 Drummond Street, Toronto, Canada, to manufacture and sell their products in the Dominion of Canada. Nicromatic has sales offices in Windsor, Toronto, and Montreal.

Conversion Chemical Corporation manufactures and sells Kenvert chromate conversion coatings for corrosion protection to nonferrous metals.

### COMMERCIAL FILTERS ACQUIRES NEW DIVISION

Commercial Filters Corp., a subsidiary of Ogden Corp., has acquired the branch offices and warehouses of W. A. Case and Son Manufacturing Co., located in Niagara Falls, Buffalo, Rochester, Syracuse, Olean and Jamestown, N. Y.

This distribution organization will operate as W. A. Case Company division of Commercial Filters Corporation. These branches will stock a representative line of Fulflo and CFC filtration equipment, as manufactured in their plants at Melrose, Mass., and Lebanon, Ind.

### GULTON ESTABLISHES NEW SALES OFFICES

Establishment of five new district sales offices has been announced by Gulton Industries, Inc.

Located in Atlanta, Boston, Denver, Miami and San Francisco, the new company-manned offices represent a 100 per cent increase in the growing national sales organization of the company, which also includes offices in New York, Metuchen, Philadelphia, Washington and Dayton.

The announcement also included the appointment of Ed Berman as New York district sales manager. Other newly appointed district sales managers are: for Miami, Ira Schulman; for Denver, David Rufus; for Boston, Jerry Smith; for Atlanta, Kenneth Gans and for Philadelphia, Joseph Cuesta.


**BUFFS FOR INSIDE POLISHING**

GOBLET BUFFS, TAPER BUFFS, CYLINDER BUFFS, SMALL POLISHING WHEELS, RAZOR EDGE BUFFS, and many others for deburring, polishing and grinding any internal contour.

Write for additional information or contact your local dealer. These buffs are stocked by many dealers throughout the country.

We manufacture a COMPLETE LINE OF BUFFS including full disc loose and sewed buffs and polishing wheels. Our metal center BIAS TYPE BUFF may help cut your polishing costs.

Your request on your letterhead will bring our complete catalog by return mail.

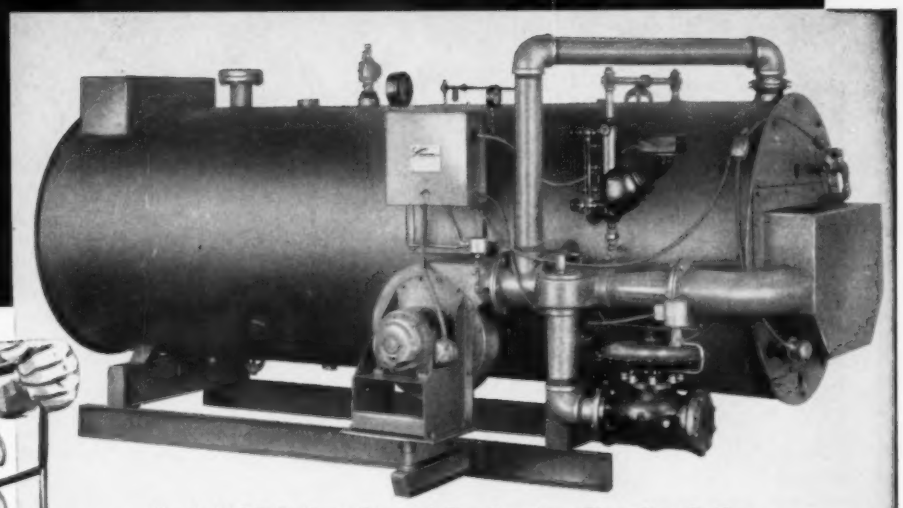
**BARKER BROTHERS INC.**

ESTABLISHED 1911

1658 Summerfield Street Brooklyn 27, N. Y.

Canadian Distributor — LEA PRODUCTS COMPANY, Montreal

# AT LAST A BOILER DESIGNED FOR THE PLATER!



Model 105 Sellers Closed Combustion Chamber Boiler

NOW—No more foul fumes because of incomplete combustion due to back draft through boiler created by exhaust fans or poor draft conditions.

SELLERS solves this problem with the improved design, closed combustion chamber boiler. All air for combustion, both primary and secondary, is pushed through the boiler under positive pressure, independent of partial vacuum in the building and independent of any back draft on the chimney (of course, products of combustion must be removed from building).

A positive pressure blower supplies air under pressure which is mixed with the gas and passed to burners in the completely closed combustion chamber; to complete combustion, secondary air is fed into the closed chamber under positive pressure (many times greater than the vacuum in the building). By this method of securing positive complete combustion, burned gases are pushed through the boiler and FOUL FUMES ARE ELIMINATED.

*Read about these Extra Features in Catalog 5206*

1. NOW—SCHOOL ROOM QUIET
2. ALL-ON, ALL-OFF RUNNER PILOTS
3. NO OPEN FLAME
4. WORKS ON LOW GAS PRESSURE
5. POSITIVE PRESSURE BLOWER OVERCOMES BUILDING VACUUM AND CHIMNEY BACK DRAFT
6. SIZES FROM 15 HP TO 200 HP

## Sellers ENGINEERING CO.

4876 N. CLARK STREET CHICAGO, ILL.

Blast Heaters • Immersion Automatic Water Heaters • Combustion Units • Industrial Gas Burners
Vertical Steam Boilers • Immersion Tank Heaters • Gas Combustion Equipment



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 432.

# Brass Plating

●

Maybe spring brings forth a young man's fancy but it also brings out extravagant claims from many sources. For over ten years we've been selling materials for brass plating which do all we claim and more. It would be easy to promise much by way of brightness and performance but we think most plating is done with a view to securing the best results at the lowest cost regardless of fancied claims.

●

We have installations which are plating brass at a rate of over .002" per hour consistently. We have installations matching practically every color of brass both on flash and heavy plate. We have provided these people with consistent materials that make their job easier and with the information to keep them running at all times. The plating efficiency is high so you don't need large currents to make up for wasteful low efficiencies. The equipment is simple. The solution is capable of analysis and correction by your own lab. The trouble-shooting is simple and not dependent on constant revision of instruction and special additions.

●

It seems to be prevalent to bring out old formulas which look exotic and promise much and to bill them as new. These formulas have long dropped into discard because of difficulties which have not been corrected. All of them cost more to make up and to use than our basic formulas. We can supply you with makeup and maintenance materials for both still tanks and barrels in all the common richlow and yellow brass colors which give uniform results at a low cost.

●

We make copper and zinc cyanides which explains our competitive advantage. We also make sodium and potassium copper cyanides as dry powders and have made them for several years. The prices are below competition. Our production is increasing but demand is too. Let us quote you on your requirements. We can take care of a few additional orders. The sodium or potassium copper cyanide which dissolves easily in water with no residue is the most convenient method of adding copper to any cyanide solution.

**TRUE BRITE CHEMICAL PRODUCTS CO.**
98 FALLS AVENUE OAKVILLE, CONN.


# INDUSTRY NEWS BRIEFS

### BUREAU OF SHIPS TO CHANGE TESTS

It is the intent of the Bureau of Ships to change the cost allocation of qualification tests for Specifications MIL-P-0020218B (SHIPS), Plating, Chromium, Electrodeposited, Porous. The terminal date for tests at Government expense is August 5, 1958. Qualification tests requested after that date will be at the expense of the manufacturer.

Copies of the specification may be obtained from the Commanding Officer, Naval Supply Depot, Scotia 2, New York.

### WORLD ZINC AND LEAD INDUSTRIES TO LAUNCH RESEARCH PROGRAM

World-wide zinc and lead industry interests together with the American zinc and lead industries will embark on a broad program of expanded research activities aimed at the consolidation and expansion of existing markets and the discovery of new ones.

Plans for the new research program have been revealed by John L. Kimberley, executive vice president of the American Zinc Institute, Inc.

As representative of the zinc industry, the Institute declared that extensive plans are now being formulated to sponsor and stimulate both applied and fundamental research. According to Mr. Kimberley, a staff to supervise the program expansion is now being formed and the next step will be the broad placement of zinc and lead research-development projects in research centers, universities, engineering schools. Foreign as well as domestic producers will help finance and supervise the program, he said.

### 1957 PRODUCTION OF LEAD IN THE UNITED STATES

Production of recoverable lead from domestic mines decreased to 333,500 tons in 1957 from 352,800 tons in 1956, according to preliminary figures compiled by the Bureau of Mines, United States Department of the Interior. Output during the first 4 months of 1957 was maintained at a higher average monthly rate than the average for 1956, but average output during the remaining months was considerably lower owing to declines in lead and zinc prices beginning in May which caused many of the mines to shut down or curtail production rates.

Under the stabilizing influence of Government acquisitions for the National stockpiles, the New York price of lead had held at 16.00 cents a pound from January 13, 1956 through May 8, 1957. The Government continued to purchase domestically produced lead for the strategic stockpile on a monthly basis throughout 1957, but after the end of April it greatly restricted the quantity of foreign lead to be acquired for the supplemental stockpile under the barter program. On May 9, the price of lead declined to 15.50 cents a pound, and subsequent decreases of ½ cent on May 16, 1 cent on June 11, and ½ cent each on October 14 and December 2 reduced the price to 13.00 cents. The zinc price, which also influences lead production, dropped from 13.50 cents to 10.00 cents a pound (Prime Western grade), East St. Louis, during the period from May 6 to July 1, and remained at the 10-cent level through December. Thus the prices of both metals were at the lowest levels since March 1954.

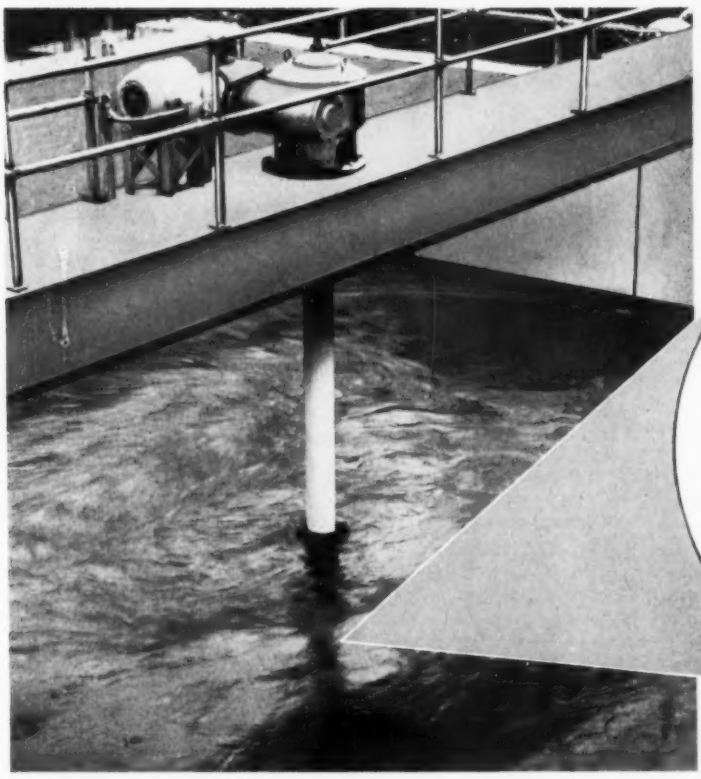
On September 27, the Emergency Lead and Zinc Committee, representing a large segment of the domestic lead and zinc industry, petitioned the Tariff Commission for relief under the "escape clause" provisions of the Trade Agreements Extension Act of 1951. The Commission immediately began an investigation of conditions in the industry with a view of submitting its recommendations to the President at an early date.

### COPPER SULFATE IN 1957

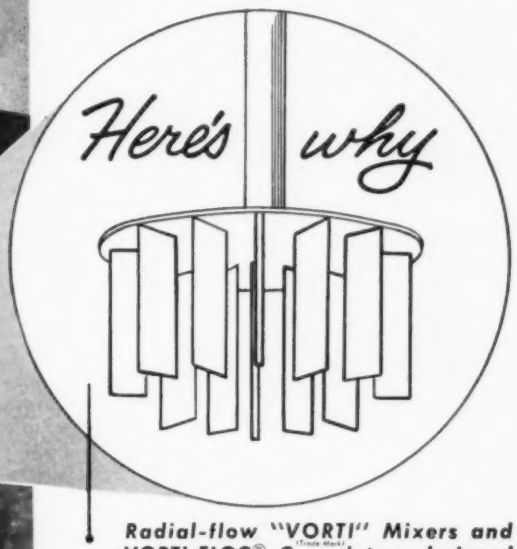
Production and shipments of copper sulfate in the United States in 1957 rose 6 and 5 per cent, respectively, over 1956.

# *You get better results*

## WITH INFILCO EQUIPMENT



***for* Mixing *and* Flocculating**




***Radial-flow "VORTI" Mixers and VORTI-FLOC® Coagulators, designed by INFILCO engineers, move larger volumes of liquid at lower impeller speeds than other types.***

### Higher efficiency at lower operating cost

"VORTI" Mixers are applicable to most problems of mixing and agitation. The impeller is usually suspended from the top of the basin without the use of underwater guide bearings, stuffing boxes or submerged chain drives.

"VORTI-FLOC" units are used for chemical treatment or for self-coagulation. They create gentle flow and turbulence by moving large quantities of liquid at relatively low velocities, thus promoting coalescence and agglomeration of suspended particles.

By proper combination of speed and size of impeller, applications of INFILCO radial flow units include:

- ***Slow stirring for equalization***
- ***Blending of liquids***
- ***Neutralization***
- ***Slow stirring for flocculation and agglomeration***
- ***Rapid mixing of chemicals in liquids***

INFILCO mixers are efficient and economical. Write today for complete details.

INFILCO

The one company offering equipment for all types of water and waste treatment—coagulation, precipitation, sedimentation, filtration, flotation, aeration, ion exchange and biological processes.

**INFILCO INC.** 901 South Campbell Avenue, Tucson, Arizona
*Offices in principal cities in North America*

5533—©INFILCO INC.

# PERSONALS

L. Anderson

J. Berg

**Lawrence Anderson, Jack Berg** and **John Kerber** have been added to the Chicago sales staff of Commercial Filters Corp. The company manufactures Fulflo and CFC filtration equipment. Headquarters for all three men will be at 6409 West North Avenue, Oak Park, Illinois. Mr. Anderson will serve as a special representative. He was formerly sales engineer for the Bendix-Skinner division of Bendix Aviation Corp. Mr. Berg has been serving as a resident sales engineer for Commercial Filters in Milwaukee. He is a graduate of Marquette University and a member of The American Electroplaters' Society, Master Brewers Association and American Society for Metals. Mr. Kerber came to Commercial Filters from Goodyear Tire and Rubber where he served as a field representative. He is a graduate of the University of Arizona and a member of the American Society of Lubrication Engineers.

J. Kerber

G. A. Gibbs

**George A. Gibbs,** formerly of Bulova Watch Co., Inc., has been appointed by the L-S Plate and Wire Corp., of Woodside, L. I., as chief metallurgical engineer and chemist in charge of plant production and quality control.

Mr. Gibbs, a member of the AES, will devote his talents to development and research in the clad-metal field.

**Dr. Donald J. McPherson** has been appointed manager of the metals research department at Armour Research Foundation of Illinois Institute of Technology, Chicago.

Formerly assistant manager of the metals department, he replaces Robert A. Lubker, who was named director of research at the Alan Wood Steel Co., Conshohocken, Penna.

In his new position, Dr. McPherson will be in charge of the Foundation's research in electrochemistry, foundry and steelmaking, welding, metallurgical processes, and extractive, nonferrous, physical, powder, reactor and applied metallurgy.

An authority in the field of titanium and its alloys, McPherson joined the Foundation as a research metallurgist in 1950. He was advanced to supervisor of physical metallurgy in 1952, supervisor of nonferrous metals in 1954, and assistant manager in 1955.

**Dr. David W. Levinson** has been advanced to assistant manager of the metals research department at Armour Research Foundation of Illinois Institute of Technology, Chicago.

A specialist in physical metallurgy, Dr. Levinson has been a Foundation staff member since 1952.

As assistant manager, he will have technical responsibility for research in electrochemistry, metallurgical processes, and nonferrous, powder, and reactor metallurgy.

Joining the Foundation as a research metallurgist, Levinson was advanced to supervisor of nonferrous metallurgy in 1955.

He received a bachelor's degree in chemical engineering, and master's and PhD degrees in metallurgical engineering, all from Illinois Tech.

Between 1948 and 1952, he also served as an instructor in metallurgical engineering at Illinois Tech.

**John A. Henricks** is now associated with Allied Research Products, Inc., as a development engineer. His previous associations include the Formea Company, duPont, Tanner Chemical and the Detrex Corporation.

**Leonard Averbach** and **Herbert C. Wagner** have joined Allied's laboratory staff as technicians. Mr. Averbach was formerly associated with the Maryland Cup Company and Mr. Wagner with the Baltimore Paint and Color Works.

**George Townsend Underhill** has been elected to the newly-created post of vice president in charge of sales for The Seymour Manufacturing Co., Seymour, Conn., producers of non-ferrous metals.

Prior to assuming his present position, Mr. Underhill served as vice president and sales manager of Victor Manufacturing & Gasket Co., Chicago. Before that he was associated with The Chase Copper & Brass Co. and with F. Schumacher and Co., New York. He is a member of the American Management Association and the Chicago Executive Club.

**Huntley M. Campbell** has been named by Seymour Manufacturing Co. to direct sales at its New York office, 122 East 42 Street. He was formerly with Western Brass Products Metals, Division Olin Mathieson Chemical Corp.

G. T. Underhill

W. R. Swift

**William R. Swift** has been promoted to assistant sales manager, metal finishing chemicals department, Cowles Chemical Co., Cleveland, Ohio. In his new position, Swift will handle the direction of field activities of the department in the sales and servicing of Cowles electrocleaners, zinc phosphate coatings, and other metal finishing chemicals.

Swift is a graduate of General Motors Institute and came with Cowles in 1956 after an extensive background in the sale and servicing of metal finishing chemicals.

**L. S. Hilton** has been appointed sales manager of abrasive and diamond wheel departments of the Manhattan Rubber Division of Raybestos-Manhattan, Inc., Passaic, N. J. He was previously assistant sales manager. He succeeds **W. H. Steinberg** who is now technical consultant.

Mr. Hilton started with the Manhattan

# NEW SHAPED, EXTRUDED APW SILVER ANODES

**STANDARD SHAPES**

**CONTROLLED GRAIN SIZE: APW EXTRUSION PROCESS* controls grain size within definite limits — minimizes sheddings**

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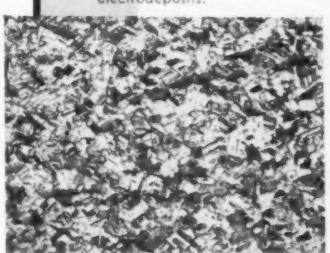

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Rubber Division in 1934 and has had wide abrasive wheel experience in the field, laboratory and manufacture. He is a graduate of George Washington University and took post graduate work at Stevens Institute of Technology.

**Howard F. Martin** has been named sales manager of Frederick Gumm Chemical Co., Inc., Kearny, N. J.

Mr. Martin received a BS in chemical engineering at Newark College of Engineering and a MChE degree at Polytechnic Institute, Brooklyn, N. Y.

He was employed as metal finishing engineer by Western Electric Co., Kearny, N. J. for five years; after which he held the position of general manager of a large production job plating shop for several years.

From 1949 he covered Northern New Jersey as sales engineer for Frederick Gumm.

H. F. Martin

L. J. Marino

**Louis J. Marino** has been appointed sales representative for Northern New Jersey by Frederick Gumm Chemical Co.

A veteran of World War II, Mr. Marino served with the U. S. Navy in the Pacific Theatre. He is a graduate of Pace College majoring in marketing, advertising and selling. He has had varied experience in selling cleaning compounds for the metal finishing industry.

**George Schore** has become an associate and partner of Brucar Equipment and Supply Co., 602 20th St., Brooklyn, N. Y.

Mr. Schore graduated from the College of the City of New York with a BS in chemical engineering. He has held responsible positions in both sales and production.

The company, which has enjoyed a reputation as a new and used equipment and supply house, will now include engineering services, specialties brightners, plant design and installation as part of its services. The engineering and technical services will be under the direction of Mr. Schore.

Mr. Schore is active in the American Electroplaters' Society, and is also a member of the Electrochemical Society, American Society for Metals and Electrodepositors' Technical Society.

**John J. O'Connor**

The AES has been grieved by news of the recent sudden death of John J. O'Connor, General Manager of C & F Plating Company, Albany, New York, and longtime member and Past President of Capitol District Branch. W. Robert Wolf, the present Branch President of the Capitol District Branch, adds:

"Jack succumbed from a heart attack Wednesday, February 12th; services and burial were on Saturday, the 15th. He was 49 years old (and would have reached the 50 mark this Spring). Surviving are his wife and four children ranging in age from 2 months to 19 years.

"Jack was a Charter Member of the Capitol District Branch, and throughout its four years of existence, he has been an active, interested and faithful member attending meetings regularly. In the 1956–1957 year, he assumed the Presidency of the Branch and carried out the duties of that office very capably. This past year, he was serving on the Board of Managers. His passing was a severe shock to all his friends and colleagues in and out of the Society.

"Jack O'Connor had been associated with C & F Plating Company in Albany for the past eleven years. Prior to that, he was employed by General Electric Company in Schenectady for seven years, fulfilling an assignment during World War II at the shipyards in Bremerton, Washington.

"In addition to his membership in the AES, Jack belonged to the Aurania Club in Albany and the Watervliet Fish & Game Club. He was an avid sportsman with fishing, hunting and golf being his favorite forms of recreation.

"Needless to say, Jack O'Connor will be greatly missed by his friends and associates, and his genial good nature will be long remembered by all who knew him."

The Society and PLATING join the Capitol District Branch in grieving the loss of this stalwart of the AES.

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# BRANCH NEWS

Total AES Branches U. S., Canada Australia, April 1, 1958—58.

### BLUE RIDGE
### Trombaugh Talks on Phosphate Coatings

The Blue Ridge Branch held its monthly meeting Jan. 10 at 6:30 p.m. at Carlton Terrace Coffee Shop. **T. R. Boggess** presided. Nineteen members and visitors were present.

**N. F. Murphy** gave a report on membership and proposed activities. One new member was elected.

**Howard Welfare** and **Fred Fulforth** reported on progress for Southeastern Branch meeting Feb. 14 and 15. The meaning and benefits of a Sustaining Membership in AES was explained and discussed.

**Paul Callahan** introduced **George Trombaugh** who gave a talk on "Pretreatment of Metals for Painting." Mr. Trombaugh is with the American Chemical Paint Company, manufacturers of phosphate coatings and related products.

Phosphate coatings for steel, aluminum and zinc were discussed with the familiar admonition for more careful control of process.

**Carl A. Witherspoon**
*Secretary-Treasurer*

### BLUE RIDGE
### Permanent Charter Approved; Kubis Address Winston-Salem Meeting

The Blue Ridge Branch held its monthly meeting at the Baptist Hospital Cafeteria in Winston-Salem, North Carolina, 6:00 p.m., Feb. 7, with **T. R. Boggess** presiding.

**Carl Witherspoon** reported that Branch's application for Permanent Charter had been approved and a meeting would be held Mar. 28 at Roanoke, Virginia for presentation of the charter by National President Francis T. Eddy and National Executive Secretary John P. Nichols.

**Nelson F. Murphy** announced that associate memberships would be extended to members of other branches. **Fred Fulforth** and **Richard R. Russel** of Southeastern Branch were elected as associate members.

**Eugene O. Eagle** introduced **Ed Kubis** who gave an illustrated lecture on cleaning cycles for all types of base metals in preparation for plating. Mr. Kubis is national industrial sales manager for Wyandotte Chemical Corp. He is secretary-treasurer of the Detroit Branch; member of the ASTM committee, B8, and member of the American Ordnance Association in Surface Preservation.

Techniques for cleanliness testing, trouble shooting and rinsing were discussed.

Next meeting was announced for March 7 at Roanoke, Virginia.

**Carl A. Witherspoon**
*Secretary-Treasurer*

### BOSTON
### Electropolishing Presented By Jumer

Boston Branch met Thursday, Dec. 5, 1957 at the Hotel Statler with President **Flores** in charge.

Three new applications for membership were received and voted on. On motion of **Andrew W. Garrett,** it was voted that the secretary be sent to the Interim Meeting at Indianapolis with transportation expenses paid by the Branch.

Communications were read from New Haven, Waterbury, New York and Newark Branches concerning their respective Christmas parties.

**Wayne Martin** then presented **John Jumer,** president of Electro-glow and Alchemize Corporations, who talked on "Electropolishing." Mr. Jumer first discussed the early history and development of the field and then the most popular types of solutions, which were primarily in the acid field.

The actual mechanism of electropolishing was briefly mentioned and was followed by a discussion of what metals could be satisfactorily polished when treated anodically.

The various proprietary electropolishing baths were then detailed, with formulation and necessary current and temperature ranges for ferrous and non-ferrous metals and alloys.

After a lengthy discussion period during which many samples were shown, the meeting adjourned at 9:20 p.m.

**George P. Swift**
*Secretary*

### BOSTON
### Successful Panel Session; Annual Meeting Plans Take Shape

Boston Branch met Thursday, Jan. 2, at the Hotel Statler, Boston, Mass., with President **Flores** in charge.

Communications were read concerning the proposed Constitutional and Bylaws changes; candidacy of **Mr. Borlet** of Grand Rapids for 3rd vice president; and the Chicago Branch Annual Meeting with the Chicago Electro-Platers' Institute. The new booklet concerning Sustaining Memberships was mentioned and **Mr. Gagnon,** Research Chairman, discussed it further.

Three new applications for membership were received and acted upon.

Under new business, there were several requests for information concerning other prospective candidates for 3rd vice president. **Hugh Foley** reported that plans for the May 3 Annual Meeting were progressing. The committee already had spent one complete evening on plans and another was scheduled to follow the Branch session.

**Wayne Martin,** librarian, then presented the panel of **Joseph T. Sullivan** of MacDermid, Inc., Elston A. Flores of Sylvania, Wayne Martin of Raytheon and **George P. Swift,** consultant, on problems concerning plating in the electronic industry. Questions concerned potential differences between rhodium and other metals, how to 'shine' copper, what is the 'best' copper, how to plate on tantalum, how to plate silver on stainless steel, how to plate on magnesium, manganese and molybdenum, buffing properties of various coppers, silver on brass, uniformity of plated deposits, agitation of gold solutions, chelating agents for plating solutions and the use of graphite paper to work out distribution of deposit.

**George P. Swift**
*Secretary*

### BOSTON
### Dr. Swalheim Discusses Cyanide Copper Plating

Boston Branch met Thursday, Feb. 6, at the Hotel Statler, with President **Flores** in charge.

The secretary's report was accepted and communications read concerning current neighbor Branch meetings, as well as Sustaining Member prospects.

Six new applications for membership were processed.

**Manson Glover** reported on the Interim Meeting at Indianapolis and **Hugh Foley** reported on the May 3 Annual Meeting.

**Wayne Martin** presented **Dr. Donald A. Swalheim** of the Niagara Falls Electrochemicals Division of duPont who discussed new developments in cyanide copper plating. Colored slides were used throughout the talk and they were arranged so orderly that the progression enhanced the interest.

Among the pertinent topics discussed were basic control, additives for brightness, additives for increasing current density range, solution composition, sequestering action of addition agents, effect of im-

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purities, bagging of anodes, roughness of deposit, interrupted current, periodic reverse current, types of anodes and relation to bright as well as smooth deposits, contaminants and methods of overcoming poor current distribution and contributing factors.

**George P. Swift**
*Secretary*

### BRIDGEPORT

#### Officers Nominated; O'Connor Pinch Hits as Speaker

The regularly scheduled business meeting and educational session of the Bridgeport Branch was held in the main ballroom of the Hotel Barnum on Friday, Feb. 14. The meeting was called to order by President **Floyd Tatum.**

Two applications for membership were presented one new member was elected and presented with membership pin and certificate.

At the New England Regional on Apr. 12 bingo for the ladies has been decided for the afternoon. Excellent prizes are being offered.

**Henry Maskowski** reported availability of a suitable grove for holding the summer outing.

**Joseph Haas,** chairman of the Bylaws Committee, selected the following committee members: **Charles Temple, Fred Lancaster, Herman Braun, Emil Bergen, George Eckholm, Bob Parker.** Meetings will be held in the near future to formulate the Constitution and Bylaws and present them to the body for its consideration.

**Al Jocis** reported that publicity had been received. However, a discussion was held as to the possibility of receiving more and favorable publicity. One way is to have photographs of scheduled speakers and a short resume of their qualifications be submitted to the newspapers prior to our meeting. It was also suggested that the newspapers be invited to photograph interesting highlights of the meeting itself, preferably at the beginning.

Nominations of Officers included: For president, **Michael Tamas;** first vice president, **Allen Ferguson;** second vice president, **William Hyatt;** Secretary-Treasurer, Bob Parker; Librarian, **H. Zingo, W. Lindsay;** Sergeant at Arms, Al Jocis, **George Haas;** Board of Managers, George Eckholm, **Ray Goral, Herman Braun, V. Consalvo, J. Mallick, R. Bonazzo.**

George Eckholm discussed the formation of the American Finishers Association, specializing in Organic Finishing. He considered it a project worthy of interested members' support.

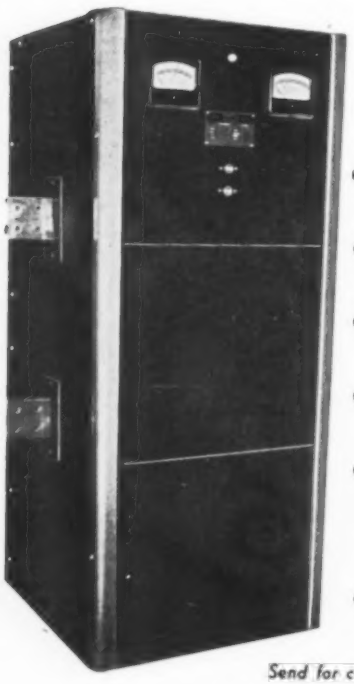
The question of nominating a deserving Bridgeport Branch member for the office of 3rd vice president in the National Society was discussed and **Messrs. O'Connor** and **Goral** accepted co-chairmanship of a committee to select and promote one worthy of the honor.

The results of the recent poll by letter ballot of the delegates to the National Society was announced as having passed both questions concerning the recommended changes to the Bylaws and per capita tax revision. A regional committee meeting will be held on Feb. 19, at the Hotel Statler, Hartford.

The Secretary read an announcement of an electroplating course continuing at the New Haven College sponsored by the New Haven Branch. **Edward Foley** of Enthone, Inc. is the instructor.

**Arthur Tetu** won the door prize.

The meeting was turned over to William Hyatt, librarian. Due to the sudden illness of **Mr. Kwasnik,** the announced speaker of the evening was unable to be present. We were fortunate in having **Raymond O'Connor,** president of Contract Plating, come to our rescue and informally discuss developments of aluminum finishing in the foreign countries from which he had just returned. The increasing importance of anodic finishing of aluminum and its prevalence in both

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the construction and manufacturing fields was disclosed. Mr. O'Connor received a rising vote of thanks for his efforts.

**Bob Parker**

### BRITISH COLUMBIA
### Corrosion Is Topic of Paper Presented by Prof. Armstrong

The meeting of Feb. 24, was held at the White Spot Dining Room. Twenty-eight members and guests were present.

A report was made by **J. Lee** concerning the Regional Meeting which has been postponed until the spring of 1959.

President **Bill Marquardt** read a letter confirming National President Francis T. Eddy's visit to Vancouver on April 16.

**J. Stoneberg** moved and **G. Smith** seconded a motion that the president appoint a nominating committee of three.

The annual election is to be held at the May meeting.

President Marquardt then introduced five dinner guests and followed with the introduction of **Prof. W. M. Armstrong** of the Department of Metallurgy, U.B.C., who spoke on corrosion. He covered galvanic corrosion, then moved to hydrogen embrittlement and residual stresses in metals. Distribution of six pages of notes covering this topic proved an exceptionally good way of remembering the main points of the speaker's subject. The question and answer period was also very well received.

The next meeting was scheduled for March 20 with Doug Hanna, Canadian Hanson & Van Winkle as the guest speaker.

**J. Lee**
*Secretary*

### BUFFALO
### Blount Talks on Plating Room Costs

The February Meeting of the Buffalo Branch was held at the Niagara Manor, 899 Niagara Falls Blvd., Buffalo.

The dinner meeting at 6:30 p.m. continues to be well attended. Our overall attendance this past year has approached the 50 per cent of membership mark, which testifies to the interesting programs, good speakers, and just general good will. **Harold Shapiro,** our librarian has done an excellent job, bringing to us experts in the field, who are cognizant of the problems confronting platers and finishers.

After the regular business of the society was cleared away, Shapiro introduced **Ezra Blount,** editor of Products Finishing magazine. As co-chairman of the Cincinnati Branch, host to the 45th Annual Convention, he invited one and all to the beautiful city on the Ohio River.

As editor of Products Finishing, Mr. Blount mentioned the interest shown in the field of organic finishing, as well as electroplating. In some areas this combination of two similar efforts is being recognized.

Mr. Blount's subject for the evening dealt with "Plating Room Costs." Surveys on cost data, made by an interested group, were presented with the methods of breakdown enumerated. The methods of determining costs and profit of several fairly large shops were also presented.

The talk was interesting and well presented. The question period at the end of the talk was lucid and instructive.

**Ralph Stemmerich**
*Secretary*

### CAPITOL DISTRICT
### Nadel Discusses Finishing of Aluminum

The Capitol District Branch met on Monday evening, Feb. 3 at 8:00 p.m. at the Hot Shoppe, Rt. 9, just north of Albany. After a satisfying ham dinner, **Milton Nadel,** manager of the Certified Plating Division of Berkley Industries was introduced by Librarian **Art Eisener.**

Mr. Nadel talked on various finishing methods and treatments for aluminum. To supplement the distributed literature, he also furnished verbally, the formulation of many of the processes and any special, related cleaning and pickling treatments. There were many questions of interest arising from Mr. Nadel's talk, which were discussed and answered to the benefit of all present.

The business meeting was called to order by President **Bob Wolf** at 9:30, after the short recess following Mr. Nadel's discussion and answer session. President Wolf explained the new change in the Society's fiscal year. The previous fiscal year was from April 1 to March 31. The new fiscal year will be from July 1 to June 30. There will be a corresponding change in dues for the coming fiscal year to include the three months interim, skipped over in the change: Dues for 1958–1959 fiscal year will be for a fifteen month


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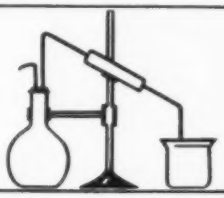

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period because of this change and will be payable April 15, 1958. The nominating committee consisting of **F. A. "Ted" Infield, Bill Naylon, Bob Hill** and Bob Wolf reported that they are now working out a slate of members to be nominated for Branch officership for the coming year. This will be reported at the March meeting.

The Outing Committee, **Ed Frieberg, Mike Guarneri** and **Nick Calantone** reported that a letter will be sent to all members asking them to denote their interest in a Spring outing, before making any definite plans.

Recording Secretary **John Green** reported that the speaker for the March 3 meeting would be **Frank K. Smith,** president of Technic Incorporated, who will talk on "Precious Metal Plating."

**John H. Green**
*Recording Secretary*

### CENTRAL MICHIGAN

**Plant Tour Draws Large Attendance**

Central Michigan Branch met for dinner and a plant tour on Tuesday evening, Feb. 4.

The site for the dinner was the Roosevelt Hotel in Lansing, Michigan.

Interest in this meeting was high as evidenced by the year's largest attendance of 62 members and guests. The occasion was a plant tour of the Oldsmobile Division of General Motors Corp.

Groups of ten, with Branch members from Oldsmobile acting as guides, toured the huge bumper plating and automated crankshaft departments.

**Homer E. Welch**
*Third Vice President and Publicity Chairman*

### CHICAGO

**Berst, McCann, Evangelides Annual Session Speakers**

On Saturday, Jan. 25, Chicago Branch held its annual banquet and educational session at the Conrad Hilton Hotel. The banquet committee did a highly commendable job in all phases of the arrangements. The first speaker at the afternoon session was **Dr. Neal Berst,** director of research, Diversey Corporation who gave a talk on "Deep Etching." This process of "chemical milling" has replaced some of the machine milling at the aircraft companies. Dr. Berst passed samples to the audience which were processed by chemical milling. He also discussed the history and latest development of this process.

**Charles McCann,** assistant to the Director of Social Research, Inc., gave a talk on "The Importance of Finishing and Packaging in Selling." Mr. McCann pointed out that advertisers seek to reach 65 per cent of the people of the nation who represent its greatest purchasing power. Mr. McCann also discussed the effects of various qualities of finish on the purchaser, ultimate consumer and purchasing agent.

**Harry A. Evangelides,** research metallurgist at Frankford Arsenal discussed "The H.A.E. Process for the Treatment of Magnesium." The talk covered an interesting background on the history of magnesium metal and the latest information in its processing and finishing.

The February meeting of the Chicago Branch was held at the Western Society of Engineers on Friday, Feb. 7, 1958. The guest speaker for the evening was **E. M. Battey** whose subject was "Waste Treatment in the Metal Trades." Mr. Battey is district manager of Infilco, Inc. He pointed out the serious need of plating plants to treat their wastes to prevent pollution and contamination. The chief offenders are two toxic compounds, cyanides and chromates. The acid wastes may be treated by (1) raising the *p*H to neutrality, (2) the cyanides are oxidized by the use of chlorine, (3) the chromates are reduced by the use of ferrous sulfate. This may be accomplished by using the batch treatment or the continuous process. Mr. Battey, with the use of slides, illustrated the various methods to treat the

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wastes. A film, then showed the various treatment plants and equipment necessary to reduce the waste to a suitable level as required by the public pollution control authorities. A question and answer period followed the showing of the film.

**C. Marzano**
*Publicity Chairman*

### CINCINNATI

**Pinner Speaks on Steel Preparation**

The Feb. 26 meeting was called to order by President **Loveless** with 39 members and guests present

Two applications for membership were approved.

**Bob Miller** then introduced **G. Ross Davidson** and **Lew Doughty,** members of the AES Editorial Board who were guests at the meeting.

**Chuck Wise** reported that plans for the National Convention were progressing satisfactorily. Bob Miller asked the Branch to send in questions for the Panel Discussion at the Convention.

**Les Helmich** reported that the membership drive resulted in 14 new members, and that **Bill Stephenson** won the transistor radio for bringing in the most new members.

The speaker of the evening was **Walter Pinner,** who discussed "Preparation of Steel for Electroplating." Mr. Pinner pointed out that the preparation of the steel begins at the mill. Tests have proven that inclusions in the steel can lead to poor corrosion resistance in the plated part. The condition of the tools and the handling of the part is very important as any imperfection in the part must be removed by polishing, and this leads to poor corrosion resistance. With the aid of slides through the courtesy of Dr. Jones of AES Research Project No. 14, it was pointed out that there are slivers of metal produced in polishing operation which cling to the part through the plating cycle. These slivers not only lead to rough plate but also to poor corrosion resistance. A double cleaning cycle has been very helpful in removing these slivers. In this cycle a good anodic etch is essential. A question and answer period followed and the group adjourned to the social hour sponsored by the Pennsalt Chemical Co., **Bill Wilson** and **Joe Claflin** hosts.

**David L. Kaplan**
*Secretary*

### COLUMBUS

**Crehan Discusses Electroless Nickel**

The regularly monthly meeting of the Columbus Branch was held at Reebs Restaurant on Friday, Feb. 7.

The business meeting was called to order by President **Calvin Smith.**

Six new members were duly approved and elected.

Delegate **Bill Neill** reported on the Interim Meeting held at Indianapolis. He told of the new fiscal year which will end June 30 instead of March 31.

Librarian **Jack Spenard** introduced the speaker of the evening, **William Crehan** of Kanigen Division, General American Transportation Corporation whose subject was "Electroless Nickel." Mr. Crehan gave a very interesting talk on its history and the present practice in using electroless nickel.

Following a question and answer session, and a round of applause for the speaker, the meeting was adjourned.

**Halvor S. Christianson**
*Secretary*

### DAYTON

**Rehme and Malstedt Speak on Chromium**

The Dayton Branch held its regular February meeting on the 19th at the Hotel Biltmore with 26 members present.

Four new members were elected.

The speakers for the evening were **Elmer Rehme,** technical representative and **Henry Malstedt** both of United Chromium Div. Metal & Thermit Co. Their topic was "Crack Free Chromium." Mr. Rehme gave a historical account of the development of both regular and crack free chromium plating and enumerated their physical properties. Mr. Malstedt, then gave the operating details of the bath and enumerated the advantages of this new plate.

Refreshments after the meeting were also through the courtesy of United Chromium and their local representative, Elmer Rehme of Cincinnati, Ohio.

**R. M. Clinehens**
*Secretary*


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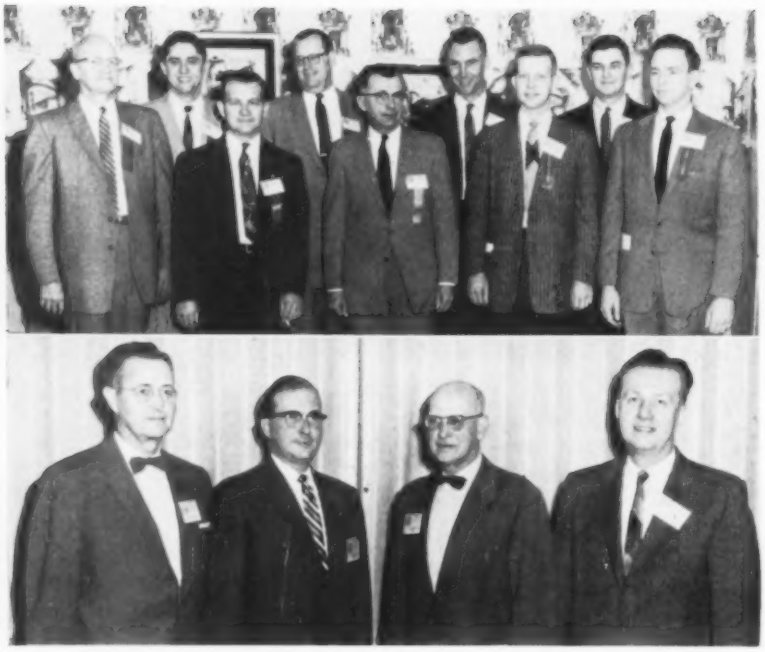

**DAYTON BRANCH 12TH ANNUAL MEETING PARTICIPANTS**

(Top) Front Row, left to right—Holle Luechauer, president; Richard Clinehens, secretary; Byron Bowman, tickets; Jack Blair, program and advertising; Norbert Mollman, educational. Back Row—Bennie Cohen, co-chairman; Robert Ruleff, entertainment; Jack Baker, general chairman; James Shane, hotel arrangements. (Bottom) left to right—Ralph Wysong, John Winters, Dr. Frank Hightower, James Hesler.

### DAYTON
### Annual Meeting A "Huge Success"

The Dayton Branch opened their 12th Annual Educational Session at 1:30 p.m. Saturday, March 1 at the Hotel Biltmore.

Opening remarks were made by Dayton Branch President **Holle Luechauer. Norbert Mollmann,** Dayton Branch librarian then introduced Honorary Chairman **Ralph D. Wysong,** AES National 2nd Vice President. After making a few remarks concerning the aims of the Society, its growth and the benefits derived from meetings such as this, Mr. Wysong introduced the first speaker. He was **James C. Hesler,** manager of the Water and Waste Treatment Division of Industrial Filter & Pump Mfg. Co., Chicago. The topic was "Procedures for the Recovery or Destruction of Metal Finishing Wastes."

Next to be introduced was **John B. Winters,** president of Incar, Inc., Cleveland, Ohio. Mr. Winter spoke on "The Anode's Side of the Story."

Next to be introduced was **Dr. Frank W. Hightower,** staff engineer, Branson Ultrasonics Corp., Stamford, Connecticut, who presented "Ultrasonic Cleaning for Plating."

All three papers proved to be very interesting and informative. Each was followed by a lively discussion period.

A demonstration unit operated by the local representative of Branson Ultrasonics was on hand for actual cleaning demonstrations after the educational session.

The banquet in the evening was attended by 496 members and guests. There followed an excellent floor show and dancing to the music of Karl Taylors Orchestra. Everyone had a good time and as always the Dayton Branch Annual Meeting was a huge success.

**R. M. Clinehens**
*Secretary*

### DETROIT
### Ladies Night: By and For the Ladies

The annual Ladies Night program was held on March 7, 1958 at the Statler Hotel.

About 350 members and wives were treated to an outstanding talk by **Miss Irene G. Meyers** of Fort Wayne, Indiana. The speaker, a retired supervisor of women's activities for the General Electric Company, titled her talk "Around the World in Forty Minutes." Her descriptions of personalities were vivid and alive and kept the attention of the audience at all times.

The technical chairman of the evening was **Mrs. Howard J. (Betty) McAleer,** President of the Detroit Branch Auxiliary. In addition to introducing the speaker, she extended an invitation to the women to become part of the auxiliary.

Dancing and refreshments were enjoyed from 9:30 p.m. till 12:30 a.m.

**J. D. Thomas**
*Educational Chairman*

### DETROIT
### Record Membership Attained; Levy, Cassidy, Kahler on Automobile Trim

The largest attendance in a good many meetings overflowed the Michigan Room of the Statler Hotel for the annual Old Timers Night held on Friday, Feb. 7. It must have been gratifying for the Lecture Series Committee under **Fred Brune** to behold the fine turnout for the symposium —"Performance of Plating on Automobiles"—presented by representatives of the big 3 automotive manufacturers.

The meeting was opened by **Glenn Friedt Jr.,** president, who welcomed the numerous members and guests. **Manuel Ben,** 1st vice president and chairman of the Membership Committee, introduced 20 candidates for membership and 6 transferees from other Branches. With their election the Branch membership totals 745—a new record.

President Friedt announced that the next meeting, March 7, is to be Ladies Night and an innovation will be added: dancing from 9:30 to 12:30. The speaker for the night will be **Miss Irene Meyers** of Fort Wayne and G. E. Co. (retired) who will give her enlightening talk "Magic Flight to Europe."

**Doug Thomas** introduced the speakers, **G. G. Levy,** Chrysler Corp.; **V. Cassidy,** Ford Motor Co. and **H. A. Kahler** of General Motors Corp.

Mr. Levy explained that the evening's discussion will concern only the trim plated parts on an automobile, and not the hundreds of other parts which are plated for a variety of purposes. The trim parts are plated for two basic reasons, appearance and durability. The Chrysler Corporation conducts a continuous research on the durability of plated parts. Not only on their own manufactured cars but for the entire industry. Mr. Levy illustrated, by means of chart slides, the results of these studies which disclosed quite a variance in the life of plated parts on the unidentified various makers of cars and the durability of the plated surface on different base metals. Among the findings it was ascertained that plated steel parts tend to have greater life than zinc die cast parts. The Chrysler Corp.'s means of grading the specimens was also explained by Mr. Levy.

The Ford Motor representative, V. Cassidy, gave a graphic illustration of the increasing amount of trim parts which are plated on automobiles down through the years by use of slides. The first slide was a 1917 Ford complete with nickel plated radiator cap, door openers and hubcaps and appropriate slides followed to show the increase in ten-year intervals down to the resplendent 1957 Ford with its numerous plated and anodized trim parts. Mr. Cassidy described a test, for trim

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part corrosion, conducted by Ford on automobiles which were subjected to the atmosphere of the Ford Rouge Plant area for varying lengths of times. It illustrated, very completely, the effect of the atmosphere on plated surfaces and pointed out the great importance of keeping plated surfaces clean by having frequent car washes.

The third speaker, H. A. Kahler of General Motors, gave an enlightening talk on how the company collects charts, analyzes and evaluates the data on corrosion of plated trim parts. This is carried on by the GMC Research Division and involves a complete program of training the technician in evaluating the affected trim on the automobile. This requires a considerable amount of study to enable the technician to ascertain the extent of corrosion (pit marks, scaling, etc.) in a given area. The GMC system of rating durability is also specified by AES Project No. 15 in rating accelerated test panels for that project.

### GRAND RAPIDS

#### Annual Banquet Attended by 500

The Grand Rapids Branch 20th Annual Educational Session and Dinner-Dance was held Saturday, Feb. 15 at the Pantlind Hotel in Grand Rapids.

Approximately 110 members and guests attended the educational session which got underway at 10:30 a.m. with the educational chairman, **Orville Hoxie,** introducing the first speaker, **George Bruggink,** Grand Rapids City Engineer. His topic was "Metropolitan Aspects of Waste Control." Mr. Bruggink gave the group a very good explanation of the troubles that can be encountered in the sewage treatment process when electroplating wastes are present in excessive concentrations. Along with his explanation he outlined a program by which local industry and the city sewage system can get along together without taking costly and drastic measures of waste treatment.

Following Mr. Bruggink's talk **Chet Harvey,** area representative of the State of Michigan Water Resources Commission was introduced. His topic was "State Approach to Pollution Control." Mr. Harvey graphically explained the measures the state government is taking to control and regulate the effluent which is released into streams. Each industrial establishment is treated separately and a set of concentration limits is set up to fit its particular circumstance and the industry is required to live up to these limits. Mr. Harvey also suggested many ways that industry can make its job easier for themselves, such as segregation of wastes, water conservation, stagnant rinses, etc.

Following Mr. Harvey's talk, luncheon was served in the Kent State Room. Frederic B. Stevens, Inc. was the host at the luncheon. Distinguished guests were **Ralph "Duke" Wysong,** 2nd vice president of the National Society and **Don Austin,** Detroit Branch, member of the AES Editorial Board.

Following luncheon the group strayed from the field of electroplating and listened to a talk by **"Les" Lear,** contract engineer with Lear Inc. on "Rockets, Missiles and Pertaining Facts." This proved to be a very timely and interesting talk and a spirited discussion followed.

The evening's festivities got underway in the Grand Ballroom at 7 p.m. with the banquet. There were 500 members and guests in attendance. General Chairman of the event was **Paul Waalkes,** 1st vice president of the Branch.

**Don Smith**
*Publicity Chairman*

### HAMILTON

#### Jackson Reports on Electroplating Control

The regular meeting of the Hamilton Branch was held at Fischer's Hotel on the evening of Friday, Jan. 17.

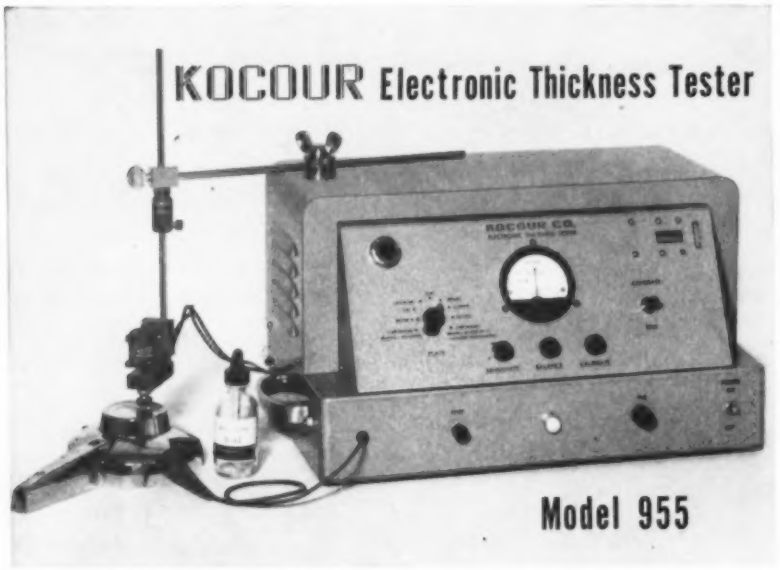
The business meeting was called to order by President **B. Teal.**

It was announced the annual Spring Dance will be held April 11.

After the business meeting the guest speaker **Joseph L. Jackson** was introduced. Mr. Jackson illustrated with interesting slides his report on "Recent Development in Electroplating Control."

Refreshments were provided by **Al Lee** of Pennsalt Co. after a lively question and answer period. A very well attended meeting adjourned at 11:15 p.m.

**D. Darby**
*Recording Secretary*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## HARTFORD

### Bright Nickel Plating Presented by Saltonstall

The regular Branch meeting was held at the Hotel Bond on Jan. 20 and 49 members and guests were present. Preceding the meeting a movie was shown entitled "Building a Character Metal."

The guest speaker for the evening was **R. B. Saltonstall** of the Udylite Corp. whose subject was "Bright Nickel Plating."

Mr. Saltonstall gave a brief review of the development and changes made in the bright nickel baths to obtain bright, ductile deposits having good levelling characteristics. Mr. Saltonstall's talk was mainly on the corrosion properties of nickel deposits underlying chrome. The mechanism of corrosion was explained and it was found that the corrosion is not caused entirely by porous nickel as has been commonly believed, but the type of chrome deposit over the nickel plays a bigger part in the corrosion mechanism. Chrome deposits from higher temperature baths, 130° as against 110°, and higher ratio baths as 200 to 1 instead of 100 to 1 produced a less porous and more crack-free deposit. Dual coatings of nickel—a deposit of dull nickel first and then bright nickel over it—also improved the corrosion resistance. Many slides were shown of various nickel and chrome deposits corroding under various conditions.

The technical chairman for the evening was **Walter Dyber.**

**Stanley Platoz**
*Secretary*

## HARTFORD

### Rinker Discusses Precious Metal Plating

The regular Branch meeting was held at the Hotel Bond on Feb. 17 and 17 members and guests braved near zero temperature the day following the blizzard to attend this meeting. Preceding the meeting a movie in color "Research in Steel" was shown through the courtesy of the United States Steel Corp.

The guest speaker for the evening was **Edward Rinker** of the Sel-Rex Corp. whose subject was "New Developments in Precious Metal Plating."

Mr. Rinker briefly reviewed the history of precious metal plating and stated that prior to the year 1930 very little work was done with these metals. Mr. Rinker spoke mainly on the gold and rhodium which are used because of their good corrosion resistance and, in the case of rhodium, good reflectivity. He pointed out the new developments in present-day baths—in the new gold baths: no galling, fine crystals, good slip characteristics and good metal distribution. New baths are operated cold and at a lower *p*H producing harder plated metals. Silver and antimony plating were briefly touched upon.

The technical chairman for the evening was **Ralph McCahan.**

**Stanley Platoz**
*Secretary*

## KANSAS CITY

### Panel on Waste Disposal

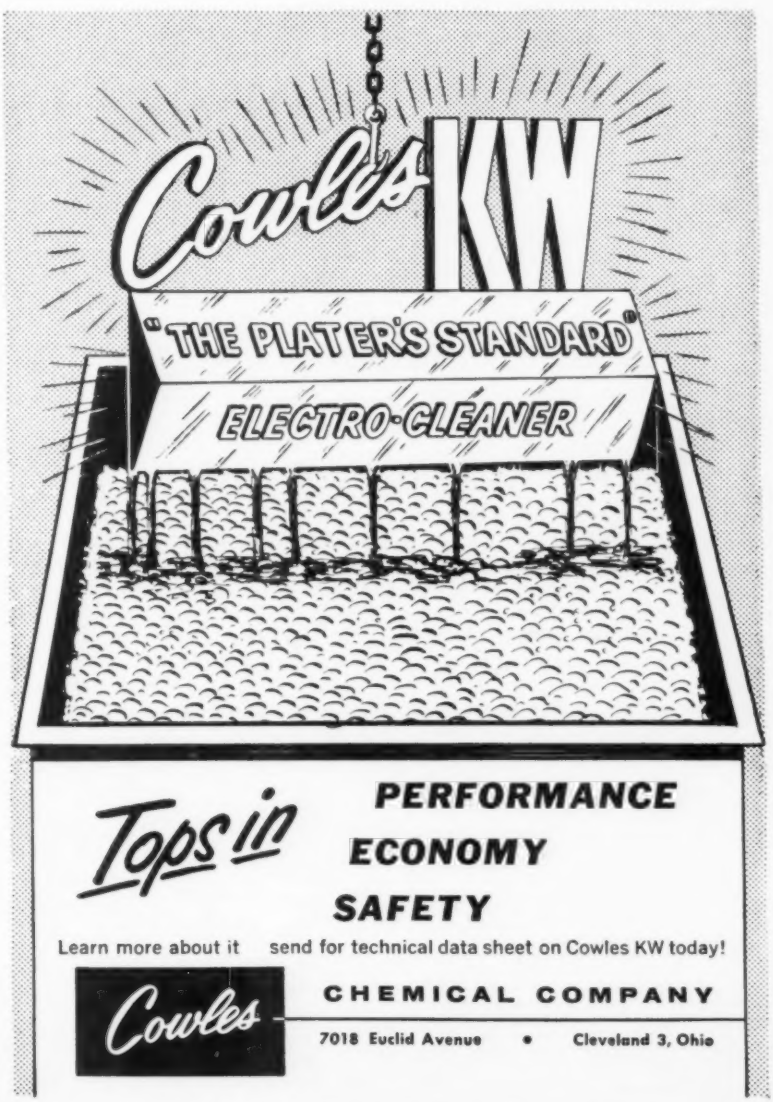
The Kansas City Branch of the AES met in regular monthly session Thursday, Feb. 13, at the Berkshire Hotel, in Kansas City, Mo.

Thirty-four members and guests completely removed all traces of a family style chicken dinner. At 8 p.m. the meeting was called to order by President **George Becker.**

Five applicants for membership were elected.

The president appointed **Robert Garrett, Glen Wilson and Bob Vandiver** as a committee to make arrangements for the annual Stag Party to be held sometime during the month of June.

The meeting was turned over to the librarian, **Scott Sterrett,** who announced that the program for the evening was devoted to a presentation by members of the Plating Department at Trans World Airlines Overhaul Base near Parkville, Mo. **Robert C. Garland,** foreman of the department, presided, assisted by **Tom Sawyer** and Robert Garrett. They presented an outline of the design, operation and control of the waste disposal plant in use by their company for the disposal of plating shop waste. Mr. Garland gave figures on the cost of the installation, costs of operation for the past ten months and





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3—3000/1500 AMPERE, 12/24 VOLT, **CHANDEYSSON**, Exciter-in-head.
1—2000/1000 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING.**
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1—1000 AMPERE, 30 VOLT, **IDEAL**, Exciter-in-head.
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co-ordinated the discussion which followed. Mr. Sawyer explained the actual operation of the plant and illustrated his description of the equipment with pictures he had taken. Mr. Garrett discussed the principle of operation and the methods of control used. The three then answered questions on the plant and facts concerning the method used which might be applied to other plants. When all apparent questions had been answered the group was thanked and the meeting was turned back to the president.

**Robert L. Garrett**

## LANCASTER

### Jackson Presents Barrel Plating

The regular meeting of the Lancaster Branch took place on Feb. 14 at the Old Mill Inn, Lancaster, Pa., with twenty-four members present on a very cold and windy evening.

One new member was elected. The secretary reported with deep regret the passing of Branch member **Oscar Border** of York, Pa.

A brief discussion was held concerning the plight of job plater's and manufacturers with respect to the application of certain aspects of the Pennsylvania Use Tax. **Lewis Briggs** of the Erie Plating Company, Erie, Pa., has written to Pennsylvania Branches to inform other AES members of the results of hearings held in Harrisburg.

**William Jackson** of the Udylite Corp. was introduced by **Charles Boll**. Mr. Jackson gave an interesting talk on the subject of "Barrel Plating and Processing Equipment."

The meeting adjourned after enjoying a buffet at the Old Mill.

**Robert S. Plaisted**
*Branch Secretary*

## LOS ANGELES

### Precious Metal Plating Weisberg's Subject

The regular monthly meeting of the Los Angeles Branch was held at the Roger Young Auditorium on Wednesday evening, Jan. 8.

Following the dinner, the meeting was called to order by President **George Magurean**. There were 102 members and guests present.

**Milton Weiner**, sergeant at arms, introduced the 19 guests. They represented a variety of interests among the major industries in the Los Angeles area, and were given a warm welcome by the membership.

Our 1st vice president, **Norman McEwan**, introduced two prospective members whose applications were placed before the Board of Managers. Mr. McEwan then introduced six new members for induction into the Branch.

Following the items of new business, which included a job opportunity in India, the speaker was introduced by Librarian **Frank Virgil**.

The speaker, **Alfred M. Weisberg**, technical director of Technic, Inc. and vice president of the Chicago Branch gave a fine presentation on the "Metallurgy of Precious Metal Plating." His presentation was very comprehensive and was well received. He answered many questions on the plating of circuitry and electronic components, which are becoming a major industry in this area. His talk was well presented and was informative and interesting.

**Emmett H. Babock**
*Secretary*

## LOUISVILLE

### Peake Talks on Organic Finishing

The regular monthly meeting of the Louisville Branch was held on Thursday, Feb. 20, at Hasenour's Dining and Cocktail Lounge. Dinner was served at 6:30 p.m., and the business meeting followed at 8. Thirty members and guests were present.

**Allen D. Russell, Victor L. Baltzell,** and **Arthur A. Oertel** volunteered to assist the Educational Chairman at the National Convention on behalf of this Branch.

**Kenneth C. Reifsteck** introduced the speaker, **Thad Peake** of Reliance Varnish Co., Louisville, Ky. Mr. Peake delivered a very informative talk on organic finishing. He discussed various types of paints, enamels, and lacquers with regard to where they should be used, and the various methods of application. He described quality checks used in the industry, and told us about some of the newer finishes being introduced like the acrylic resin type. A question and answer session followed, and Mr. Peake was heartily applauded for a very worthwhile presentation.

**Frank E. Wilcher Jr.**
*Secretary-Treasurer*

## MILWAUKEE

### Weisberg and Helms Present Papers

The 485th regular meeting of the Milwaukee Branch was called to order by President **E. H. McCoy** at the Maryland Hotel, on Jan. 10 at 8 p.m.

**Les Diveley** moved that the Room Committee be instructed to look for a new place to hold meetings. **Gene Diellusch** seconded the motion and it was passed unanimously by the membership.

The president appointed the regular Delegates to represent the Milwaukee Branch at the Mid-West Regional meeting Jan. 25, in Chicago. Les Diveley suggested that the president also be present.

The Secretary read a letter from the Grand Rapids Branch requesting the support of the Milwaukee Branch in the candidacy of **Chester G. Borlet** for the office of National 3rd Vice President at the 1958 Convention in Cincinnati.

**Eugene Piellusch**, Educational Chair-

man, presented **Alfred M. Weisberg,** vice president of Technic Inc., to the Inorganic Section. He spoke on "Precious Metal Electroplating." His talk covered the effect that the addition of trace metals have in precious metal plating solutions. Modification, proper application and control of gold, silver, platinum and rhodium plating solutions were discussed.

**John W. Helms,** advertising and public relations manager of Parker Rust Proof Co., spoke to the Organic section on "Industrial Phosphate Coating Treatments." His address covered a new cold phosphating process.

**S. R. Taterzynski**
*Secretary-Treasurer*

### MISSISSIPPI VALLEY
### Warner Discusses Thickness Testing, Iwema Talks on Paint

The January meeting of the Mississippi Valley Branch was held the 15th at the American Legion in Moline, Ill. Forty persons attended the dinner and meeting.

The meeting was called to order by President **Barney Nordblom** at 8 p.m. He introduced several guests among whom was **Boyd Ramsey,** the teacher for the chemistry course sponsored by the Branch.

Mr. Nordblom appointed **Vern Kron, Carl Dunk, Clyde Shepherdson,** and **Art Jackson** to the nominating committee for the April election of officers.

It was announced that Barney Nordblom, **Al Dennhardt, George Parisho,** and **Lloyd Gilbert** would attend the meeting in Chicago on Jan. 25.

George Parisho reminded those present of the National Convention to be held in Cincinnati.

President Nordblom then turned the meeting over to Librarian **Stan Baker** who introduced **Walter Warner** of the Kocour Co. who gave an interesting talk on thickness testing. In his discussion he covered the various methods used including drop test, automatic Magnagage, electronic dermitron and strip method.

Upon completion of Mr. Warner's talk, a demonstration of the electronic thickness gauge was given.

**Pete Iwema** of Du Pont was then introduced and he gave a talk on classification of materials used in paint and lacquer. The high points of the talk included films formed by chemical reaction.

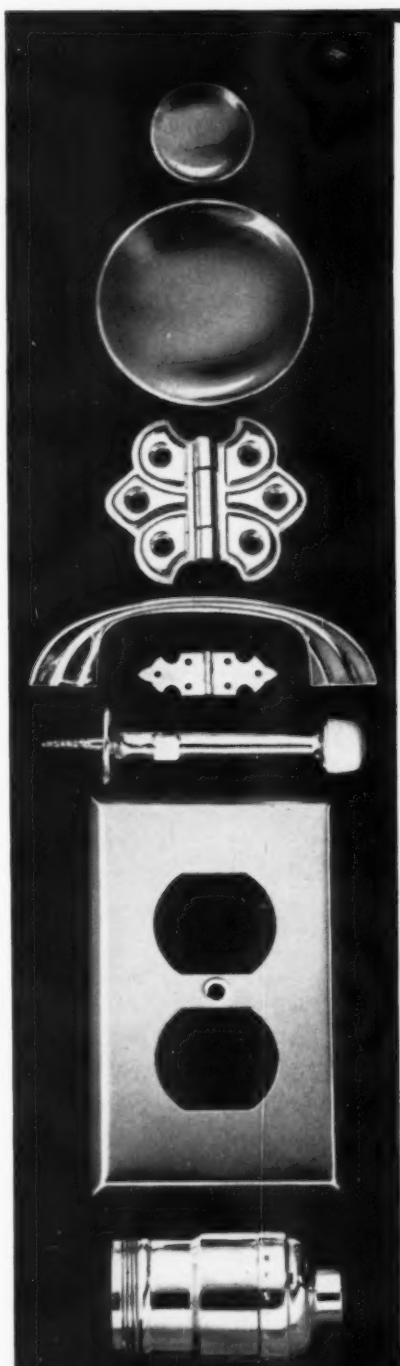
A discussion period followed. Meeting was adjourned at 10 p.m.

**John L. Hartman**
*Secretary-Treasurer*

### MISSISSIPPI VALLEY
### Lamb and Kanning Present Papers; Annual Program Announced

The February meeting of the Mississippi Valley Branch was held the 19th at the American Legion Club in Moline, Ill. Approximately forty-five members and guests were present.

The meeting was called to order by

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**1. Lower labor costs.** Operating a CEC vacuum coater takes no special skills. Labor costs per piece are far lower than in traditional methods because the process is *fast*.

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**3. Lower material costs.** Ten cents worth of aluminum will vacuum-plate thousands of parts such as those shown here. Lacquers are relatively inexpensive, too.

**Added durability**

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(LEFT) Class in basic electroplating sponsored by the Newark Branch, Feb. 18 at Oakite's Laboratories in New York City. (CENTER) Gerald Lux, Oakite's director of technical education, demonstrates detergency to the electroplating students. (RIGHT) John H. Banta, left, Oakite technical service representative in northern New Jersey, discusses an electroplated part with other members of the Newark Branch Education Committee. Front row, Flavio LaManna, Gustav Bittrich, chairman, Ken Anderson and Robert Ehrhardt. Back row, Dodd S. Carr, Charles Rack, Samuel Frey, John Kosmos, Gerald Lux and Al Zocchi.

President **Nordblom. George Parishó** gave a report on the Education Session to be held on April 12 at Johnny Hartman's Restaurant in Davenport, Iowa. The papers for the afternoon program will be as follows:

1. Survey of Modern Chrome Plating, presented by a representative of Metal and Thermit Corporation.
2. Chromate Conversion Coatings for Non-Ferrous Metals by C. W. Ostrander of Ray Strickland of Allied Research Products Inc.
3. Causes and Cures of Some Common Defects in Paint Films by Harris Beck of Glidden Company.

A Fashion Show for the ladies will be held at 2:30 p.m. The evening will consist of dinner and dancing.

President Nordblom gave a report on the Chicago meeting.

**Vern Kron** and **Art Jackson** of the nominating committee reported on the nominations for the next year.

Nominations were:

President, Bernard Nordblom; 1st vice president, **Paul Chamberlain;** 2nd vice president, **Stan Baker;** secretary-treasurer, **John Hartman;** librarian, **Jake Knanisher.**

The meeting was turned over to **Stan Baker** who introduced the first speaker of the evening, **Robert Lamb** of Minnesota Mining and Mfg. Co.

Mr. Lamb explained and discussed the various tapes available for various masking purposes. He emphasized the insulation or conductive qualities of the various tapes for use in electroplating.

The next speaker was **Dr. Eugene Kanning** of Kanartex Coatings of Galesburg, Illinois, who spoke on "The Technology of Modern Organic Coatings."

Dr. Kanning enumerated all the various important new ingredients of modern coatings. He cited the important role of chemical research in the development of new pigments, vehicles, solvents and additives.

**John L. Hartman**
*Secretary-Treasurer*

## MOHAWK VALLEY

### First Christmas Party Successful; Naughton at Jan. Meeting

On Saturday evening, Dec. 14, 1957, the Mohawk Valley Branch held its first annual Christmas Party. Over 60 members and their wives were in attendance at Thompson's Hotel, Yorkville, N. Y. The crowd enjoyed a cocktail hour, dinner and dancing. Corsages were provided for the ladies and door prizes were awarded. If this was an indication, our Annual Christmas Parties should be our gayest social event.

At the Jan. 16 meeting, **James Naughton,** sales representative for the Olin Mathieson Chemical Corp., spoke on "Waste Disposal for the Small Operator." Mr. Naughton pointed out that our own AES research project at Yale University was probably the biggest effort put forth in the field of waste disposal. A very interesting question and answer period followed.

The membership then enjoyed refreshments through the courtesy of **Fred Johnson** and **Cecil Thornton,** local MacDermid representatives.

All meetings of the Mohawk Valley Branch are now held at Thompson's Hotel in Yorkville, N. Y.

The Board of Managers are at present preparing for the coming election of officers to be held at the March meeting.

**C. P. Raehm Jr.**
*Secretary-Treasurer*

## NEWARK

### Pinner Addresses Sustaining Members Meeting

**William Grigat** called the Feb. 21 meeting to order with 70 members in attendance. Secretary **Foulke** reported on the program of the N. J. Sewage and Industrial Wastes Annual meeting of interest to platers.

Four applications were received and four elected to membership.

**Howard Cobb,** chairman of the Nominating Committee (also **Cliff Struyk** and **Robert Ehrhardt**) presented a slate to be voted at the March meeting.

The Branch voted to contribute $25 to the Newark Chapter of the Red Cross as in the past. Don Foulke, in the absence of **George Wagner** (enjoying? the frigid breezes in Florida) reported a satisfactory profit for the Christmas Party.

**Ed Faint,** it was reported, was recovering nicely from an operation and a minute of silence was observed in memory of **Sol Barr,** long-time member of the Branch who passed away early in the week.

Robert Ehrhardt then introduced the representatives of the Sustaining Members attending as guests of the Branch.

**Dr. Morgan,** Bell Telephone Laboratories, Inc.; **Joseph Wenick,** Corono Corporation; **Howard Martin,** Frederick Gumm Chemical Co.; **Robert Norton,** Hanson-Van Winkle-Munning Co.; **Eugene Wagner,** Hy-Grade Electroplating Co.; **Mario DiChiara,** Royal Plating and Polishing Co.; **Al Korbelak,** Sel-Rex Corp.

**Fred Meyer,** librarian, introduced Bob Ehrhardt, chairman of the Research Committee who spoke on the "General Activities of the Research Committee. He outlined the philosophy motivating the committee, the contributions of many to the program, including those of Newark Branch who have been active and described the various projects presently active.

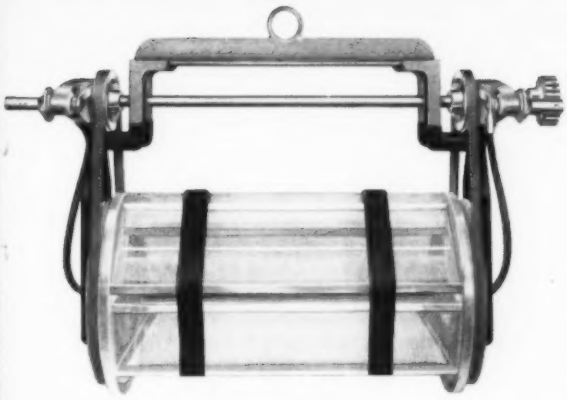
**Walter Pinner,** as the chief speaker of the evening, in his usual capable fashion described in some detail the progress being made by Project No. 15 towards developing a satisfactory method for checking plated coatings by accelerated methods with respect to corrosion. The acetic acid salt spray test, the modification of this test incorporating the addition of copper chloride to the solution and the Corrodekote method were described as well as the history of the development of these performance test methods. The number of questions and comments attested to the interest and approval of this research project.

**D. Gardner Foulke**
*Secretary*



INDICATE A 453.➤

# the NEW STUTZ COMPLETE CYCLE BELT DRIVEN PLATING CYLINDER



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These units are the result of our experience with industry and service plating. The belt design has now proven superior to gear driven types, and with outboard mounted driving pulleys, belts can be changed if necessary, in seconds without tools. In addition to our own equipment these units made to fit all makes of plating tanks and furnished also with motor drives mounted directly on cylinder superstructure. Cylinder current horns are heavy copper alloy and are sized for either four or three horn saddle contact. Cathode contactors are dangler type, others available. Standard sizes 14″x30″ and 14″x36″ (I.D.), 12 additional sizes from 12″x24″ to 18″x42″ (I.D.) Standard perforations 3/32″ round on 3/16″ centers. Special dual openings for processing of extremely small parts available.

This design incorporates cylinder pulleys separate and smaller from the cylinder head. The hanger arms are semi-steel castings protected with 5/16″ thick special vulcanized hard rubber.

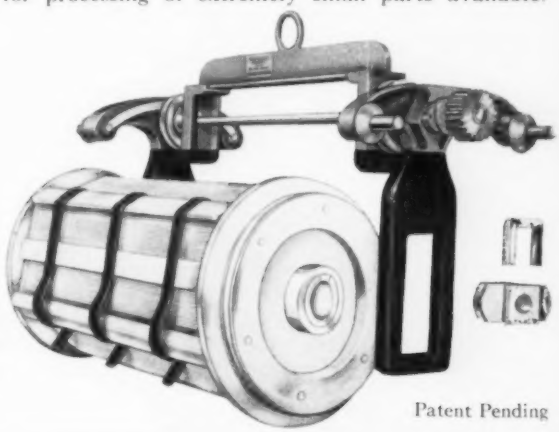
Specially designed counter pulleys of monel metal or plexiglas with deep dimples for positive grip against belt face.

Pat. Pending

This shows the belt expanding into the dimples of the driving pulleys. This action provides positive pull with no abrasion to the belt whatsoever.

Patent Pending

Simply lifting the top piece vertically from the dangler holder, allows the holder to be withdrawn through the hanger slot. This releases the cylinder from the hanger.



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## THE STUTZ COMPANY

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### Newark Branch Plating Students Tour Plants

A Basic Electroplating Course is being sponsored by the Newark Branch. Forty students visited the product development and service laboratories of Oakite Products, Inc., in New York City on February 18 for the second lecture in the 1958 series.

Gerald A. Lux, Oakite's director of technical education, with the help of demonstrations by Charles Rack, service department manager, Richard Parsons, service engineer, and Samuel S. Frey, Henry Harrison and Edmund Horner, research chemists, introduced the students to the fundamentals of cleaning, water softening, acid treatment, and rinsing before plating.

The trip to the Oakite Laboratories was the second of ten such tours, designed to acquaint the young electroplaters with the modern facilities for cleaning and finishing. The courses started on February 11 with a trip to the Sel-Rex Precious Metals Co. plant, and will include visits to plating shops, plating machine manufacturing firms and research laboratories.

The course, consisting of ten weekly 2-hour sessions, is planned by a committee of the Newark Branch of the AES, including Branch President William Grigat, Chairman Gustav Bittrich and members John A. Banta, Robert Ehrhardt, Robert Horrocks, Alexander Korebelak and Flavio J. LaManna. Mr. Banta, Oakite technical service representative in northern New Jersey, arranged the Oakite tour.

Other companies cooperating in the series of visitations include Behr-Manning; Metal Finish, Inc.; Royal Plating; Pyro Metal Finishing; Hanson-Van Winkle-Munning; Kosmos Electro-Research. Dr. Dodd S. Carr, research director for Bart Laboratories, is the editor of the manual on "Basic Practical Electroplating" used in the course.

### NEW YORK
### Kushner Speaks on Stress Measurement

**Dr. Edward Saubestre,** president, presided at the New York Branch meeting on Jan. 24, at the Hotel Statler.

Mrs. F. J. MacStoker, in a letter addressed to the members of the New York Branch, expressed her gratitude for the flowers which were sent to "Mac" and for the many visits by the boys to the hospital. **Art Wood** was reported "recovering" after a recent operation. **Sam Goldstein** is home convalescing and sends thanks to his many friends who wished him well.

**Joe Rembicki,** general chairman for the banquet, reported that all arrangements had been completed.

**Milton Nadel,** who represented our Branch at the Interim Meeting held in Indianapolis, gave a highlight of the proceedings. Some of the topics under discussion were: 1) The financial condition of the National Society, 2) The proposed educational program, 3) A report on PLATING, the Society's magazine, 4) The coming convention in Cincinnati. 5) Nomination of candidates for 3rd vice president of the National Society.

A discussion of these topics will take place at the next business meeting of the Branch.

Six candidates for membership were accepted and duly sworn by the president.

Librarian **Art Carlson** presented **Dr. Joseph B. Kushner.** Joe, the president of an electroplating school in Stroudsburg, Pa., spoke on the importance of accurately measuring stress in electrodeposits. He explained thoroughly the technic employed when measuring both "tensile" and "compressive" stresses with the "stressometer." This apparatus was invented by the speaker. Everyone seemed to enjoy both the talk and the discussion period which followed.

**Anthony P. Briganti**
*Recording Secretary*

### PHILADELPHIA
### Seidel Explains Patents on Trade Marks

The regular meeting on Feb. 24 at the


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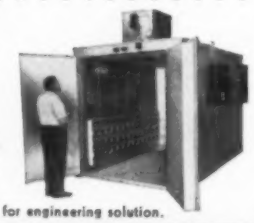

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Engineers' Club was attended by 39 to dinner and 45 at the meeting. Following the call to order, each member introduced his guests. **Eugene Zurbach** won the prize, a wallet, for bringing the most guests. Three active members were admitted and three applications were received. A door prize, donated by Textile Chemical Co., was won by **Richard Marshall.**

The minutes were read and the treasurer presented his report. **Mr. Cogan** gave a report on the planned events for Ladies Nite to be held in June. The date of the annual educational session, to be held on a day other than the banquet date of November 1, was discussed. The final date will depend on the availability of several suitable locations. The 1957 Banquet Committee was discharged with thanks and a rising vote of thanks was given Banquet General Chairman **Farren.**

The Nominating Committee presented its slate of candidates for the 1958–59 term, with the election being held at the March meeting. The elected officers will take office on July 1.

**Arthur H. Seidel,** a patent attorney, spoke on "Plating Patents and Trade-Marks." He gave a brief description on the development of the patent system; how it was of comparatively recent origin and the basic concepts behind the granting of patents. Described were the steps involved in applying for a patent, the principal parts of the patent and some of the many pitfalls possible in obtaining a patent. Mr. Seidel's talk was well presented and was interesting and informative.

**I. Wm. Marcovitch**
*Secretary*

### ST. JOSEPH VALLEY

**Committee Appointed to Mid-West Regional; Shustick is Speaker**

Forty-two members and guests attended the December meeting of the St. Joseph Valley Branch. The meeting was called to order at 7:30 p.m. by President **Arthur Wiegand.**

**Duke Wysong,** national second vice president, spoke of a communication from the Grand Rapids Branch about a joint meeting with the Die Casters Association to be held in Grand Rapids and gave particulars concerning reservations.

Three new applications for membership were read and two new members elected. Vice President and Membership Chairman **Ray Dearth** thanked the Branch for past efforts and urged further attempts to increase the present membership.

A letter from **Paul Glab,** Chicago Secretary, was read concerning a joint Mid-West Regional group meeting to be held Jan. 25 to aid in planning the 1962 convention and exposition. President Wiegand appointed **Ralph Brouwer, Gene Roth, Harold Wiesner, Henry Meers,** Ray Dearth and **Lou Rague** as a committee under the chairmanship of Duke Wysong.

The meeting was turned over to Lou Rague, librarian who introduced the speaker, **Louis Shustick,** a graduate of Niagara University and field representative for Du Pont for the past 15 years. His subject was "The Effects of Impurities in Cyanide Plating Baths."

The ideal baths are at optimum condition when the brighteners are present in very small amount, because in excess they act as poisons. They should also be easily removed when in excess.

Lined tanks, pumps and filters should be thoroughly leached before use with caustic solutions. Cyanide plating baths have good cleaning properties in themselves because of high $H_2$ evolution and high cyanide concentrations.

Mr. Shustik covered zinc, cadmium, silver, copper and brass baths, listing possible impurities, their effects and methods of removal. Slides were shown to aid in illustrating the text. The membership gratefully accorded him a rising vote of thanks for an extremely well presented paper.

**Henry A. Meers**
*Secretary*

## Opportunity to Authors

Member or non-member authors of technical and scientific papers on electroplating, metal finishing and related arts are cordially invited to submit manuscripts of original, unpublished papers to the Editor of PLATING for review and publishing consideration.

Any such paper accepted and published in PLATING will also be eligible, of course, for selection by the Society's Paper Awards Committee for the Carl E. Heussner Award; AES Silver Medal; AES Bronze Medal; George B. Hogaboom Memorial Award; Robert S. Leather Mechanical Finishing Award; Chromium Plating Award; Precious Metal Plating Award, or the John J. Hanney Memorial Award.

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**THIRD ANNUAL SOUTHEASTERN REGIONAL TECHNICAL EDUCATIONAL SESSION**

Front Row, left to right, technical speakers, Herman Ey, Hanson-Van Winkle-Munning; Clarence H. Sample, International Nickel; Dr. R. B. Saltonstall, The Udylite Corp.; M. H. Dent, president, Miami Branch AES. Back Row, Charles I. Lewis, president, Southeastern Branch; Howard M. Bone, general chairman, technical session; Francis T. Eddy, president, National Society; Dr. Nelson F. Murphy, vice president, Blue Ridge Branch; Dr. Samuel Heiman, National past president.

Front Row, left to right, Robert H. Probert, secretary-treasurer, Southeastern Branch; M. M. Randman, registration chairman; Howard M. Bone, general chairman. Back Row, left to right, Bob Taylor, program; Wilmont D. Tidd, educational chairman, George W. Taylor, program. (Not shown, Justus U. Belville, entertainment chairman).

**SPRINGFIELD**

**Turkey Shoot Success; Dyber Speaks on Copper Plating**

The Springfield Branch met at Blake's Restaurant, on Monday evening, Feb. 24 for the regular monthly meeting. A reporting of the Activities Committee on the recently held Turkey Shoot proved that not only was the shoot highly successful from a financial point of view, but it also brought in two new members. Those who attended, enjoyed themselves with an evening of good fellowship and sport. Members serving on this committee are: **Mel Roske,** chairman; **Al Salmond,** finance; **Marty Murray,** tickets; **Walt Dyber,** prizes and gifts; **Elery Gibson,** refreshments.

A Nominating Committee was appointed as follows: **Robert J. Girard,** chairman; **John E. Costigan** and **Wayne B. Sanders.** The committee will select a slate of officers for the annual Branch election and will have it ready for the March meeting.

Two new members were welcomed into the Branch.

We had with us two out of town guests in the persons of **Armand Faucher** of Chemical Corporation of Hartford, and **Frank Schneiders,** of Enthone, Inc. of New Haven.

President **Charles F. Griffin** introduced the speaker for the evening, one of our own; **Walter Dyber,** technical rep-


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|---|---|---|---|---|---|---|---|
| TO PLUG HOLE SIZE | 1/8-3/16 | 3/16-1/4 | 1/4-5/16 | 5/16-1/2 | 1/2-5/8 | 9/16-11/16 | 5/8-3/4 |
| TO CAP STUD SIZE | 3/32-5/32 | 5/32-3/16 | 3/16-1/4 | 1/4-5/16 | 5/16-3/8 | 3/8-7/16 | 5/16-1/2 |

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resentative of MacDermid, Inc. of Waterbury, Conn., and his subject "Resolving Copper Plating Problems" was very well received. Thank you, Walt!

**Henry L. Heissfeld**
*Secretary*

### TORONTO
#### Emmett Talks on Paint Finishes

The meeting of the Toronto Branch was held Jan. 10 at the Royal York Hotel, 29 sat down to dinner. There appears to be a little drop in members for dinner so come on fellows let's get behind this year's officers and given them a little encouragement.

Secretary **Ernie Hutt** reported that **Kergan Wells,** better known as "Old Rip," brought back a report from Washington and a vote of thanks to both the Toronto and Western Ontario Branches for their extra $100 contribution to the Research Fund. He represented the Toronto Branch at the Interim Meeting in Indianapolis on Jan. 11, being appointed official delegate, we wish him a pleasant trip and know that the interests of the Branch are in capable hands. Ever-welcome **Bill Findlay** from the Hamilton Branch and 40 members of the Toronto Branch were present at our meeting to learn about paint finishing.

Wednesday, March 26, is planned as Millionaire's Night.

**Pat Patterson** introduced our speaker, **Harry E. Emmett,** technical service director, Glidden Co., Ltd. Toronto. Harry has 22 years in the field of automated finishing and it was quite interesting to learn the various ways of applying paint finishes, and the saving that can be realized by using the right procedure. "Well done Harry." The speaker was extended a hearty vote of thanks by **Tom Jackson.** The meeting adjourned at 9:10 and a social evening followed with cards and refreshments.

**A. M. Wilson**
*Librarian*

### TORONTO
#### Industrial Waste Important Topic

The February meeting of the Toronto Branch was held in the Royal York Hotel on Friday the 14th. Fifty members left their Valentines at home and sat down to dinner. It was good to see **Les Pyle** up and around after his recent illness.

This was nomination night, **Bob Edwards,** president; **Roal Clark,** secretary; **Gordon Lince,** treasurer; all were elected by acclamation.

The speaker, **F. A. Voege,** was introduced by **Bert Barraclough.** His topic was "Industrial Wastes in Ontario." The Ontario Water Resources Bill has been in effect since June 1957. The question period was quite lively. **Art Severs** insisted on an answer to how much teeth the act had. This prompted Pat Patterson to say we really did not want the commission to show its teeth, but rather what we could do so as not to provoke investigations into plating shops.

Vice president **Ray Day** thanked the speaker and assured him the AES Toronto Branch would cooperate in every way. **Bernie Teal** of Hamilton, invited the Toronto Branch to their meeting Feb. 22.

**A. M. Wilson**
*Librarian*

### TWIN CITY
#### Henneman Talks About Vacuum Metalizing

The Twin City Branch held its regular monthly business and technical meeting at Jax Cafe in Minneapolis, Minnesota, on Feb. 3. Thirty-eight per cent of the membership and six guests were present.

Branch President **Warren Johnson,** and Past President **Robert Tepley,** representatives of the Twin City Branch at the January meeting of the Chicago Branch, reported on efforts being made to develop a Mid-West Regional Group of the AES. They informed the group that affirmative action has been initiated

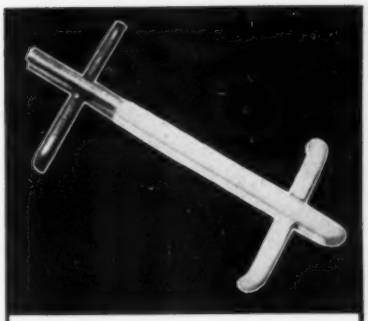
Our technical speaker for the evenmg was **William E. Henneman** of the F. J. Stokes Corp. Mr. Henneman delivered an informative lecture on vacuum metalizing techniques and applications. He supplemented his discussion with a series of slides that exemplified production vacuum metalizing. After a short question and answer period, the group displayed their appreciation.

### WATERBURY
#### Pinner Speaks on Corrosion; Officers Slate Nominated

The February Meeting was held on Thursday, Feb. 13, at the Roger Smith Hotel. This meeting was designed as our Sustaining Members' Night. About 70 members and guests were on hand and were well pleased with the talk given by our guest speaker, **Walter L. Pinner.** His subject was "Accelerated Corrosion Tests." National President **Frank Eddy** made a few remarks concerning the Research Program and turned the meeting over to **Ray Mitchell,** chairman of the Sustaining Members Committee. Mr. Pinner spoke about the need for a new accelerated test and explained in detail how the Corrodkote Test had been attained. He mentioned that in the near future, this formula would generally be accepted by the industry.

The Nominating Committee, headed by Frank Eddy, presented their nominees for the year 1958–59, they are as follows:

President, **E. J. Garland;** 1st vice president, **Frank Tirendi;** 2nd vice presi-

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| TOXICITY | Can be formulated to be non-toxic |
| AGING PROPERTIES | Good |
| LIGHT RESISTANCE | Good |
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| TENSILE STRENGTH | Very Good |
| SCUFF RESISTANCE | Very Good |
| ABRASION RESISTANCE | Very Good |
| ALKALI RESISTANCE | Very Good |
| ACID RESISTANCE | Very Good |
| OIL RESISTANCE | Very Good |
| HARDNESS | As high as 80 (Shore-A) |
| % FILM FORMING | 100% |
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| COST PER 0.001" THICKNESS | App. $.37 sq. yd. |
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**Nicholas Topazio**
*Publicity Director*

### WESTERN ONTARIO

#### Invite National Officer Visit; Winters is Speaker

The January Meeting was replaced by our Annual Ladies Nite Dinner-Dance. Many of our friends from the other Ontario Branches joined with us in an evening of good fellowship.

The February Meeting was held on Friday, Feb. 21, at the Wm. Pitt Hotel in Chatham.

Present were 23 members and guests.

President **Earl Patterson** read a letter from the Research Committee, thanking our Branch for its contribution to the Research Fund.

Secretary **Art Campbell** introduced a new suggestion system to the Branch. Forms were passed out during the dinner and were collected prior to the meeting. This system should prove stimulating and valuable.

First suggestion came from **Alex Corbit** that we attempt to have an officer from the National Society attend a meeting, to speak on the purpose and objectives of the AES. Many of our members are unable to attend the annual conventions and possibly do not fully realize the true scope and value of the Society.

**Les Crooks** suggested that we hold our May Meeting in London, Ontario. Several years ago Alex Corbit did an excellent job of arranging a London Meeting. He was again commandeered for the job.

Speaker for the evening was **John D. Winters,** Incar Limited, Cleveland, Ohio, whose subject was "Cyanide, Zinc and Cadmium Plating. Problems, Causes and Solutions." Mr. Winters gave us many practical suggestions for the efficient operation of these plating baths.

The usual social session followed the meeting.

**D. R. Mainland**
*Vice President*

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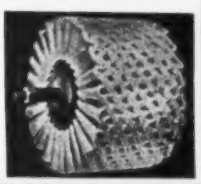

## FUTURE MEETINGS

AES

**April 19—4th Empire State Regional Meeting,** Manger Hotel, Rochester, N.Y.

**May 3—Boston Branch**—Annual Educational Session and Banquet, Hotel Statler, Boston, Mass.

**May 17—St. Louis Branch,** Annual Banquet, Chase Hotel, St. Louis, Mo.

**May 19-22—45th AES Annual Convention,** Sheraton-Gibson Hotel, Cincinnati, Ohio.

**November 1—Philadelphia Branch,** Annual Educational Session and Banquet, Hotel Sheraton, Philadelphia, Pa.

**January 31, 1959—Cleveland Branch,** Annual Educational Session and Dinner-Dance, Cleveland, Ohio.

**June 14-18, 1959—Golden Jubilee Convention and International Exposition, AES,** Detroit, Mich.

**July 10-14, 1960—47th AES Annual Convention,** Hotel Statler, Los Angeles, Calif.

INTERSOCIETY

**April 27-May 1—The Electrochemical Society, Spring Meeting,** Statler Hotel, New York, N. Y.

**April 28-May 2—Institute of Metals,** Jubilee Spring Meeting, London, England.

**May 5-7—13th Purdue Industrial Waste Conference,** Purdue Memorial Union Building, Purdue University, Lafayette, Ind.

**May 12-16—American Society for Metals,** First Southwestern Metal Congress and Exposition, State Fair Park, Dallas, Texas.

**May 14-16—Society for Experimental Stress Analysis,** Spring Meeting, Hotel Manger, Cleveland, Ohio.

**May 18-20—Metal Finishing Suppliers' Association,** Annual Convention, Sheraton-Gibson Hotel, Cincinnati, Ohio.

**May 18-20—National Association of Metal Finishers,** Annual Convention, Management Seminar and Banquet, Sheraton-Gibson Hotel, Cincinnati, Ohio.

**June 9-12—National Materials Handling Exposition,** and American Society of Mechanical Engineers National Conference on Materials Handling, Public Auditorium, Cleveland, Ohio.

**June 14—Masters' Electro-Plating Association of New York, 40th Annual Banquet,** Hotel Astor, New York, N. Y.

**June 22-27—American Society for Testing Materials,** Annual Meeting and Exhibit, Hotel Statler, Boston, Mass.

**November 18-20—9th National Conference on Standards,** American Standards Association, Hotel Roosevelt, New York, N. Y.

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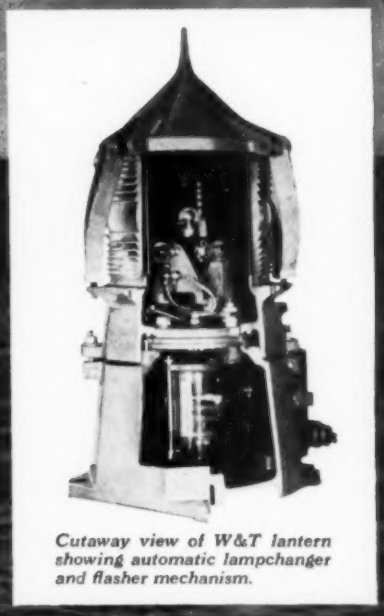

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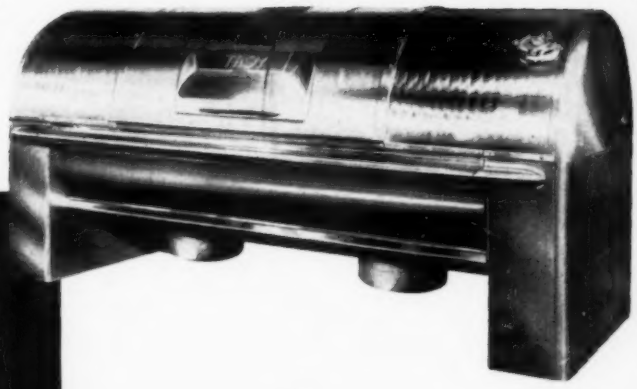

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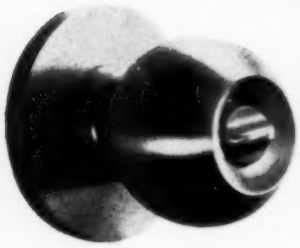

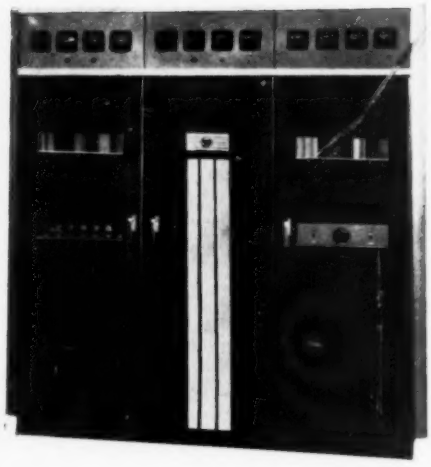

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